EDITORIAL

CHEER UP! The I. W. W. convention at Sioux City was a flat failure.

AS if we did not have troubles enough, the horrors attendant upon July 1 are likely to be increased by a nation-wide telephone strike.

FIFTY years ago, on the 10th of this month, the last spike in the first transcontinental railroad was driven near Promontory, Utah. A regular air-service over this and several other routes seems likely to come in the near future.

PEOPLE that are clamoring to have 'the boys brought home' would do well to remember that the boys are being brought home as fast as they were sent over. Is it customary to criticize a fire-truck for slowness when it is coming from a fire at the same speed as it used in going?

FAR-EASTERN trade with the United States amounted to $1,644,963,279 in 1918, or 18% of the total foreign trade of the country. It is also twice the Far-Eastern trade in 1914 and greater than the entire foreign trade of the country during any year preceding 1891. When freight rates have been arranged to give Pacific coast ports a fair show they will obtain most of this business.

SEVERAL of the daily newspapers recently published an interview with a returned officer of American forces in Siberia, in which he tells of great improvements made by the American engineers in the Siberian railroad service. Trains are even running on time. Question, shall we move to Siberia, or shall we ask the War Department to recall the American expedition and have its members take over the operation of the railroads in this country?

THE first sale of Government-owned wooden ships, or, for that matter, of any of the vessels built for the Emergency Fleet Corporation, was made April 17, when ten 4700-ton and five 4000-ton freighters were purchased by the Nacirema Steamship Co. of New York. The vessels were built for approximately $165 per dead-weight ton, and have been sold at about $145 per ton, a net loss of $20 per ton, to be sure, but, nevertheless, a considerably smaller loss than is expected will be the average for the entire fleet of the United States Shipping Board. The purchasers are negotiating for the purchase of 15, and possibly 30, more wooden ships of the same types. All the vessels just bought will be used in the transatlantic trade, five running from New York, five from New Orleans, and five from Havana. Ten of the ships were built by the National Shipbuilding Co. of Orange, Texas, and the remaining five by the Supple-Ballin Shipbuilding Corporation of Portland, Oregon. The Shipping Board is now receiving bids for several more wooden vessels and will soon sell its entire stock, about 400 in all.

A PRICE of $149 per ton has been named by the Submarine Boat Corporation, of Newark, for the construction of eight 12,000-ton steel freighters, and it is understood that other yards, including some of those on the Pacific coast, have made bids almost as low. Considering that wages have not been reduced at all, and that the prices of material have gone down only a little, this represents a remarkable shrinkage in costs as compared with the ships now being launched, some of which are said to cost as much as $225 per ton. Pre-war prices on the few ships then being built in American yards ranged from $50 to $70 per ton. Another aspect of the case is furnished by the fact that the Government has recently sold some wooden vessels at $145 per ton. If Uncle Sam can build steel ships of a size and type better suited for general cargo work than the wooden boats for only $149 per ton, perhaps he is not going to lose so heavily on his shipping investments after all.

GOVERNMENT plans for vocational re-education of disabled soldiers and sailors have been so widely discussed in this and many other periodicals that it might seem to be a matter of common knowledge throughout the country, and particularly among the discharged men themselves. However, the Federal Board for Vocational Education finds that this is not the case. Seriously crippled men have returned to civil life entirely ignorant of the Government plan and are trying to support themselves unassisted. Other men, perhaps not so badly injured, have disregarded the chances for improvement in their earning capacity offered by the re-education plan and have gone to work in the best available job, showing a fine spirit of independence, it is true, but poor judgment. The assistance offered by the Board is not charity, it is the least the rest of us can do for the men that have sacrificed so much in the country's service. At the same time, the men that are re-trained are more useful to the community than they otherwise would be. If any of our readers are acquainted with a disabled soldier whose disability, whether acquired in battle or in camp, interferes with his regular vocation, he should advise him to communicate at least with the district office of the Board, Monadnock building, San Francisco.

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The Victory Loan

This issue will reach our readers shortly before the conclusion of the Victory Loan Drive. It does not require either a prophet or the son of a prophet to predict approximately what the situation will be, judging from the experience of past drives. Many localities, counties, and States will have gone 'away over the top', but most of the country will still be behind the quotas assigned. Then will come the final spurt and the Loan will be considerably over-subscribed. It is to the importance of joining in this last spurt that we would call your attention. And in doing so, it is unnecessary to mention the patriotic motive, strong as that is and should be. Most of us are dependent, directly or indirectly, at one time or another, upon the ability of the banks to extend credit. The more of the Victory Loan that is taken by private citizens, the less the banks will have to carry and the better able will the banks be to extend credit to the peace-time activities of the country when necessary. Therefore, if you have not already subscribed to the Victory Loan to the limit of your ability, go and do so now.

Speed the Parting Guests!

The Savings Bank Section of the American Bankers' Association is much alarmed over the departure of many Bolshevik-inclined foreigners to Europe, and wants something done about it. The particular trouble, the bankers say, is that these people are carrying away with them from $2000 to $10,000 in cash apiece. They say that hundreds of thousands will go. It is unfortunate to have all that money leave the country, but even at that, it seems to us to be a case of good riddance. There are many worthy foreigners that have good reasons for returning to their native countries, and whose departure we may regret, but could not wish to hinder. But anybody that is fool enough to want to leave America at this time and go to live in Europe will not be missed at all, except perhaps pleasantly. Furthermore, we do not believe that anyone of that class ever got as much as $2000 together without stealing it, and few of them have had either the brains or the opportunity to steal that much.

Saturday Holiday Plan

A new way to meet the Saturday half-holiday problem is being tried at the yard of the Pacific Coast Shipbuilding Company at Bay Point. Instead of a half-holiday every week, the men get a whole holiday every two weeks. The present general demand throughout the industrial world for some sort of a Saturday holiday makes this plan well worth consideration. Probably nearly all the workmen would prefer it. On the employer's side, there would be some advantages. If the plant is closed down entirely on alternate Saturdays, the output would probably be practically the same as when half-holidays are observed, but certain 'stand-by' overhead charges would be reduced. If, on the other hand, the plant runs all day Saturday, but with a reduced force, output remains unaffected, but other 'stand-by' charges are reduced, particularly if it is possible to close certain departments. The actual choice between the various plans, would probably depend on the individual plant. A jobbing concern, for instance, would probably find it convenient to be open for business as many hours as possible. A firm that confined itself strictly to manufacturing might prefer to close entirely on alternate Saturdays. Other firms might prefer the straight half-holiday. In the long run, the question is one of maximum efficiency.

Psychology and Naval Supremacy

Every once in a while, somebody writes a book that tells us another point where the Germans came near winning the War, and didn't. The latest is Admiral Jellicoe, whose book, 'The Grand Fleet, 1914-1916', has recently been published, and who certainly is well-informed regarding naval matters. Contrary to the general belief, the British had only a small margin of superiority over the Germans in capital ships at the beginning of the War. Furthermore, they had less than half as many destroyers and were inferior in shell and armor protection. Yet the German fleet delayed coming out to do battle until nearly two years after the War started. Then, after the battle of Jutland, over two years elapsed before it came out again, this time in ignominous procession to the most shameful surrender known to history. The explanation is probably found in the difference of morale. British sailors had a long tradition behind them, not always, to be sure, of victory, but always of gallant fighting. The Germans had not any such tradition. In other words, before you can do a thing, you have to think you can, and if you think you can do a thing, you can do it. Victory Loan subscribers —and solicitors—also men in the Pacific Coast metal trades, take notice.

Foreign Trade Opportunities

Almost everyone expects a considerable expansion in the foreign trade of the United States during the next few years, but there are two distinct opinions as to where the largest opportunities are to be found. One class of prophets holds that the reconstruction of Europe will be so rapid as to require practically all America's surplus products. The number of persons holding this view was probably greatest immediately after the armistice and has been decreasing ever since. The recent action of both Great Britain and France in restricting imports indicates the determination of the Allied coun-

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tries to favor their home markets whenever possible. Indeed, it is more than likely that the order of preference will be as follows: first, the home producer; second, producers in other European Allied countries; and last, the United States. This is natural under the present exceptional circumstances, and particularly so in view of the high rates of dollar exchange. On the other hand, if European countries pay so much attention to the intensive cultivation of their home markets, they must relax, to some extent at least, their efforts in the Orient and in South America. Therefore, the other class of prophets holds that America's best opportunities for foreign trade expansion are in the countries bordering on the Pacific Ocean. Here are countries that have not been torn by war. On the contrary, many of them have large stocks of the raw materials we want waiting a chance to be shipped and exchanged for our machinery and other manufactured goods. In the trade with these countries, the Pacific Coast occupies the preferred position.

Price Stabilization Fails

Refusal on the part of Mr. Walker D. Hines, Director-General of the United States Railroad Administration to accept the steel prices 'suggested' by the Industrial Board, of the Department of Commerce leaves the entire question of stabilization 'wide open' once more. Mr. Hines objects particularly to the size of the differential between the price of billets and that of rails and other railroad necessities. On the other hand, Mr. George N. Peek, chairman of the Board, points out that the price fixed on rails, $47, is only $17 more than the pre-war price, although the United States Steel Corporation's figures show an increased cost in direct labor alone of $19.48 per ton. Mr. Hines frankly and flatly repudiates the idea that the Railroad Administration is under any obligation to accept the findings of the Industrial Board. The other departments of the Government are showing signs of a desire to follow the example of the Railroad Administration. The entire dispute will probably be referred to President Wilson on his return from France, and past experience in similar disputes indicates that there will be a long delay before final settlement. In the meantime, the market continues in an unsettled condition, and before a decision is reached, is quite likely to stabilize itself, perhaps at a lower, perhaps at a higher figure than the prices set by the Board. The steel industry, as the most important basic industry, was selected as the first for the stabilizing experiment, and the Board is naturally disinclined to proceed further with its work until that question is settled. The result seems likely to be that all markets will continue without guidance until natural causes produce stabilization. In fact, Judge Gary, of the United States Steel Corporation, says that the work of the Board is a complete failure. This may or may not be a good thing. The price-stabilization plan, however, has not received a fair trial, and its apparent failure is not necessarily an indication of lack of merit.

Hurley Ship-Plan Favored

An interesting plebiscite has been held by 'The Marine Review', of Cleveland, among ship-owners and ship-builders regarding the various provisions of Mr. Edward N. Hurley's plan for operation of the Government-built ships, which was summarized in these columns last month. The principal features of the plan received the approval of a majority of both classes, although the size of the majority varied considerably on the different points. Regarding the two most important provisions, namely, private ownership, and its corollary, sale of ships at the market price, opinion was almost unanimous. The ten-year period of payment and the placing of as much insurance as possible with American companies also received general although not unanimous approval. About four-fifths of those voting were in favor of the Government carrying the insurance on its equity during the payment period. The requirement of Government consent to transfer to foreign registry received the approval of two-thirds of those voting, as did also the provision for Federal incorporation of the ship-operating companies. The provision of a 'Merchant Marine Development Fund' to assist in financing new steamship lines during the development period received a three-fourths vote. When it came to the provisions for one director appointed by the Government serving on the board of each company, and for a permanent committee of these directors meeting periodically at Washington, there was considerable dissent, but both of these proposals received a bare majority. The vote may be taken as a fair indication of the sentiment of the ship-building and ship-operating public, and, as such, should carry considerable weight.

A New Plan for the Railroads

Mr. Walker D. Hines has visited us, and has told what he thinks about the railroad problem and what ought to be done about it. Whatever opinion they might have had about Government operation in general and the present freight and passenger service in particular, his hearers could not but agree that Mr. Hines makes a straightforward talk with no attempt to dodge responsibility. The present unfortunate financial condition of most of the companies he attributed partly to unavoidable delays in bringing the railroads back to a peace basis of expenditure, and partly to the general slackening in most lines of business since the armistice, which has reduced receipts. Both these conditions would have occurred if the roads had remained in private hands, and are, furthermore, probably only temporary.

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For this reason, it is likely that further increases in either freight or passenger rates will not be necessary, and, in any case, no action should be taken until business conditions are more nearly normal. Turning to railroad purchases, he flatly denied the charge that the Railroad Administration is deliberately holding back from purchasing railroad supplies. At the time of the armistice, the railroads had accumulated or had under contract large stocks of certain supplies, much larger than were needed for peace requirements. Furthermore, the small volume of present business requires less than the ordinary peace equipment. In addition to all this, the uncertainty as to the final disposition of the railroads, makes the Railroad Administration hesitate about incurring expenses for equipment or betterments that may not become useful before the railroad companies resume control. No direct allusion was made to the present dispute over price stabilization. Mr. Hines' audience was naturally enthusiastic when he placed himself on record as in favor of a removal of such inequalities in rates as give Atlantic ports an unfair advantage over Pacific ports in foreign trade. As to the future disposition of the railroads, he definitely declared himself opposed to Government operation, and in favor of a return to private operation, and, by implication at least, as soon as a satisfactory plan can be worked out. However, a return to pre-war conditions would be inadvisable. Instead, Mr. Hines proposed the consolidation of all the railroads in a relatively small number of systems, probably between 12 and 20, the strong roads taking over the weak ones, by Government compulsion if necessary. These systems should be competitive rather than regional. A sufficiently large return on railroad securities to attract capital should be guaranteed by the Government, but this return, because it would be so guaranteed, could be relatively small. Net profits over and above this guarantee would be divided between the Government and the companies. Government representatives would serve on the directorates of the railroads, and these Government representatives would also form part of the central regulating body, thus providing the co-ordination between the management and the regulating bodies that has been conspicuously lacking in the past. Although Mr. Hines expressly stated that he was speaking simply as an individual, his recommendations undoubtedly will, and should, carry great weight, both with the Administration and with Congress. While such a plan has not been proposed before on such a wide scale, there are many features of it that resemble the provisions of the 'indeterminate-franchise' charters under which street-railway companies are now operating satisfactorily in several cities.

Acceptance of Half-Holiday as a Result of Government Intervention

The controversy between the California Metal Trades Association and the Machinists Union, which struck to enforce the 44-hour week in violation of its agreement, was ended by Governmental intervention. Although the Macy Board recognized agreements between employer and employee that did not conform to its award, yet the shipyards in the San Francisco district were threatened with cancellation of contracts unless they opened their yards and gave the 44-hour week, conforming to conditions both in Eastern and other Pacific coast yards. The shipyards could not hold out under these circumstances, nor could the outside shops 'carry on' alone. There remained nothing to do but meet the demands, although it is the opinion of many well-informed men that the machinists would have been back at work in a week. The employers' association regretfully accepted the inevitable.

A memorandum was prepared by the California Metal Trades Association and William Hannon and Robert Fechner, representing the Machinists' International Union, setting forth the terms under which the men were to return to work. The conditions were substantially as follows. The men returned to work April 4. Saturday, April 5, they worked seven hours, April 12 six hours, and April 19 five hours. Beginning April 26 the Saturday half-holiday was started. The men employed in shops outside the shipyards were given a bonus of $25 for machinists and $17.50 for helpers in lieu of the retroactive pay given the shipyard workers as provided by the Macy Award. The Macy scale of $6.40, $4.96, and $4.64 for machinists, specialists, and helpers, respectively, was not changed.

The 200 striking boilermakers of Union No. 6 went back to work on April 7 in the outside shops on substantially the same conditions. The boilermakers received a bonus of $22.50 and the helpers received $17.50 in lieu of retroactive pay from August 1 to October 24. These 200 boilermakers had been on strike since February 1 to enforce the payment of the same retroactive pay in the outside shops as was awarded to the shipyard workers.

The California Metal Trades Association and the California Foundrymen's Association received notices on April 16 from the Iron Trade Council that the agreements of January 2, 1918 and January 20, 1919, were no longer acceptable. There are now no collective bargaining agreements in force. A meeting of the Pacific Coast District Metal Trades Council is to be held at Oakland on May 5 at which it is expected a new set of demands will be prepared and that later a request will be made for a conference with the employers in order that a new agreement may be made without any more delay than is absolutely necessary.

There is no indication that it is the desire of the unions that the San Francisco Bay district become a manufacturing centre. In fact, they appear to be fighting for conditions under which competition with other districts will be impossible. Furthermore it must be admitted regretfully that increased pay has so far been accompanied by decreased efficiency, and that high wages do not bring about industrial peace.

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MAIN FLOOR OF FOUNDRY. INSERTS SHOW TRACTOR CASTINGS ON LEFT AND STAMP-MILL CASTINGS ON RIGHT

Making Steel Castings by the Best Steel Casting Company

In August 1913, the Best Steel Casting Co. started operations in one end of the plant of another concern from which it had leased space. At that time 60 men were employed and the output was approximately 50 tons of casting per month. Today the company owns a plant covering six acres of land, employs 225 men with a monthly payroll of $30,000, and has an output of 500 tons of castings per month. This phenomenal growth, although caused in a large measure by the exceptional demands of industry for steel castings during the past few years, was influenced in no small degree by the insistence of the management that their slogan of 'service and quality' be no empty promise.

The plant is situated at Elmhurst, a suburb of Oakland, and is served by both the Southern Pacific and Western Pacific railroads. The main building is 740 ft. long by 100 ft. wide being divided into three bays, the middle bay being 40 ft. and the side bays 30 ft. each. Two other buildings 30 by 740 ft. and 60 by 250 ft. are connected with the main building. Molding-floors occupy the principal part of all the buildings, the south end of the main building also contains the cleaning-room and annealing-ovens. There are two pattern-storage buildings at a little distance from the others. The offices are situated in an addition to the main building.

The main building is equipped with three 10-ton Whiting cranes, the next largest building has a 5-ton Cyclops crane, and the third has a 10-ton Shaw crane. The melting-equipment consists of two cupolas and two 2-ton converters, one Whiting and one Stoughton. Compressed air is supplied by one 440 cu. ft. and two 200 cu. ft. Ingersoll-Rand compressors. The management is now considering the addition of a 6-ton Heroult electric furnace to the equipment. This will permit the manufacture of larger castings, for which there is considerable call.

The cleaning-room is equipped with grinding-wheels, four tumbling-barrels, two Pangborn sand-blast rooms, and a complete set of Thor chipping-hammers. The sand-rammers are also of the Thor make. Nine jar-machines, part of the molding equipment, were designed by Clarence Henderson and manufactured by the Macaulay Foundry Co. of which he is manager. These have proved satisfactory. There are three mold-drying ovens, one large annealing oven, and several core ovens, all oil-fired. A laboratory is maintained in which complete analyses of the raw materials are made and also for control of the heats of steel.

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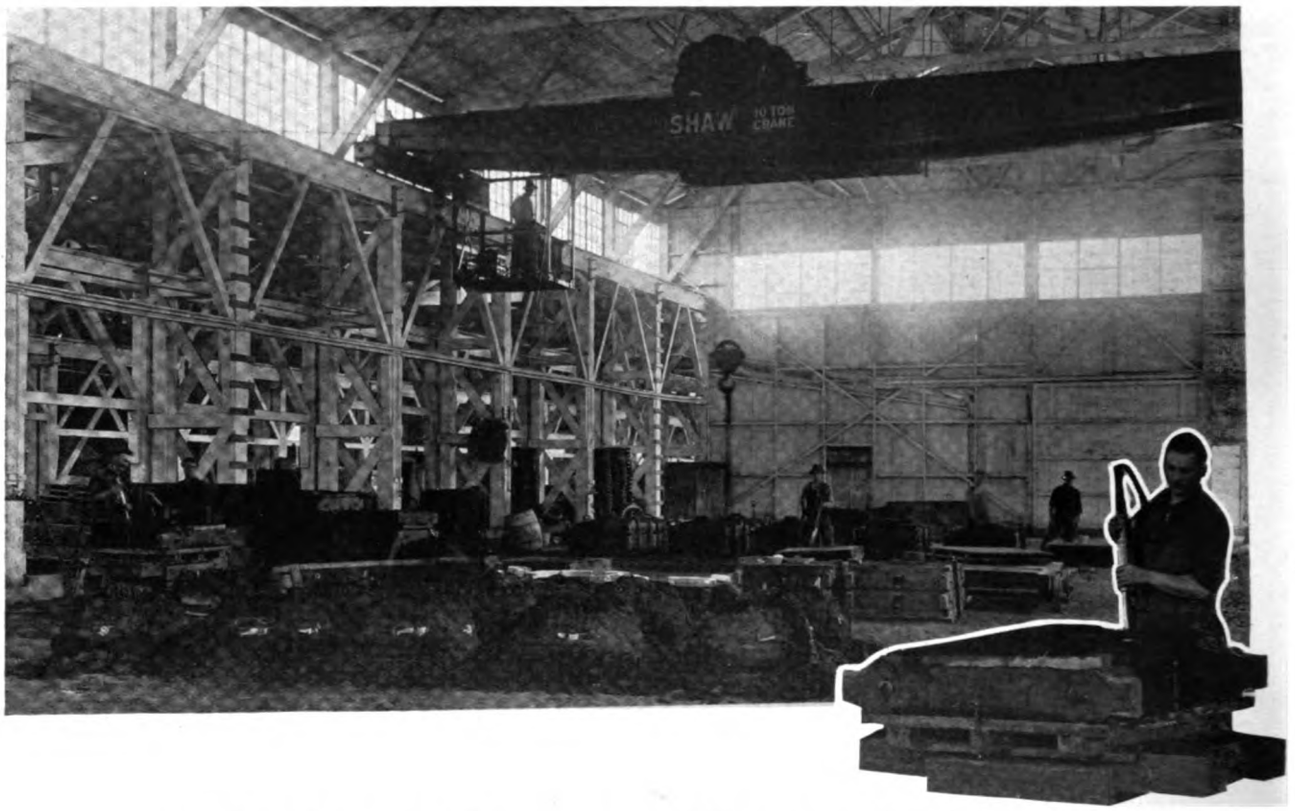
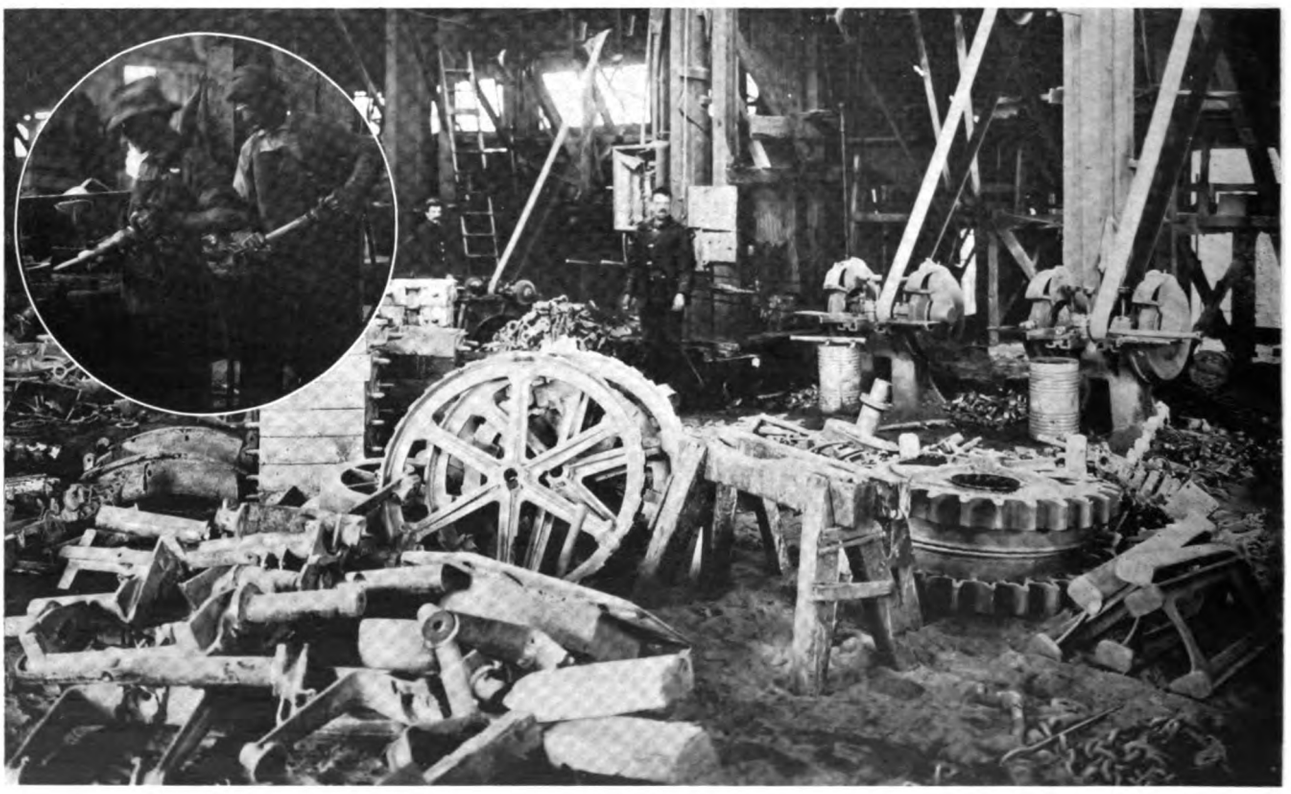


PART OF MOLDING FLOOR. BELOW—RAMMING MOLD WITH THOR PNEUMATIC HAMMER



PART OF CLEANING ROOM. INSERT SHOWS CHIPPERS USING PNEUMATIC HAMMERS

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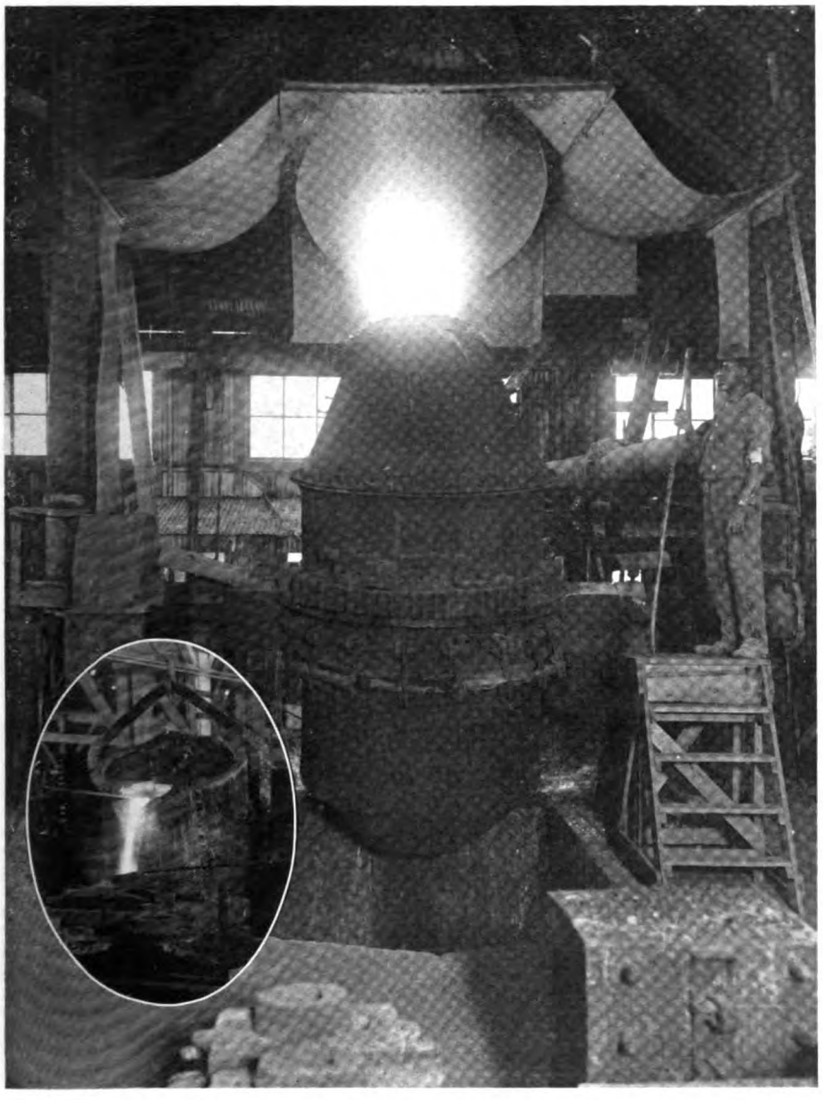
PLANT OF BEST STEEL CASTING COMPANY

The highest grade of Lebanon pig-iron is used to which is added a considerable amount of low-phosphorus and low-carbon plate-scrap prepared by the California Iron Yards Co. This scrap is practically all from the yards of the Bethelehem Shipbuilding Corporation. The silica sand used is from Ottawa, Illinois.



CONVERTER. INSERT SHOWS POURING FROM LADLE

Castings ranging in weight from 10,000 lb. down are made at this plant to Lloyd's and American Bureau specifications. The principal work is for the shipyards and railroads but a good deal of work goes also to gold-dredges, oilfields, and to tractor manufacturers. A shipment of water-wheel castings requiring great care and precision has recently been completed for the Pelton Water Wheel Co. These wheels are for a new plant that will be the largest hydro-electric plant in India. Each wheel will develop 15,000 hp. This is the greatest amount of power ever generated by one wheel.

John Twohy, vice-president and works manager for the Best company, was asked what was meant by 'service' in the 'quality and service' slogan. He stated that not the least part was speed in deliveries. An important aid to prompt deliveries is a system of routing orders through the 'order-of-works department' by which he can tell at a glance just where any particular order stands and can thus push the jobs through without delay. Particular care is given to cleaning and inspection in order to ensure the quality of the castings sent out. Mr. Twohy is an Eastern steel man, who has been on this coast for a number of years. Before starting the Best Steel Casting Co. he was superintendent for the Columbia Steel Co., first at Portland and afterward at the Pittsburg plant.

H. H. Whiting, president and general manager, is the business head of the firm. He also was in the steel business before coming to the company. The selling end is under the direction of George Gunn, who grew up in the metal industry in the San Francisco district. Mr. Gunn worked for several years for the Union Iron Works.

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Hall-Scott Motor Car Co. Starts Profit-Sharing Open-Shop Plan

The Hall-Scott Motor Car Co. of Berkeley has begun a system under which it will pay its employees a minimum wage of $6 per day and give a bonus in addition amounting to 25% of the net profits from the factory. It has put its factory on the open-shop basis and will work a 44-hour week. There is no discrimination against either union or non-union men as such. This action has been taken because of a succession of difficulties with the unions, culminating in the recent strike of the Machinists' Union in violation of its agreement.

A further purpose of the minimum-wage-and-bonus system is to make it to the men's interest to deliver the maximum amount of work and to eliminate 'limitation of output', which seems to be one of the principles of some unions. The Hall-Scott company recognizes that maximum production from its equipment is the factor that brings profits and it is perfectly willing to divide these profits to attain that end.

On April 1 every man in the plant was discharged, although some were re-hired immediately at the $6 minimum. All employees are now hired at $4 per day for a probationary period of three months. At the end of this time they are given the minimum wage of $6 or are automatically released. It is up to them to make their job worth $6. The office-help, watchmen, janitors, and some of the draftsmen are on probation at their old salaries with the opportunity of developing their positions into the $6 class.

In order to put this plan into effect it was necessary to resign from the California Metal Trades Association whose arrangements with the Machinists' Union do not conform to the Hall-Scott plan. The majority of the men employed are machine specialists on repetitive work. The $6 minimum for these men is above the union scale. The minimum of $7 for machinists is $0.60 above the union scale. There is no camouflage in the term 'minimum' according to Mr. Scott, president of the company, if an employee shows that he is worth more than the minimum he will get more. A shop committee of employees will be organized, which will handle the affairs of the employees as far as their relations with the company are concerned.

In order to be perfectly fair in the bonus, the major part of salaries of the officials is paid from the income from other investments and not from factory profits. Both Mr. Hall and Mr. Scott receive large salaries but only $3000 is charged to factory overhead. Even the interest on the cost of the plant, which represents an investment of $1,500,000 is not deducted before the division is made for the bonus.

The company has contracts for which material is on hand, which will provide work for six months. It is expected that by the end of the year 150 men will be employed. During the War as many as 500 men were working at the plant.

Shipbuilders Protest Against Cancellation of Contracts

Following the report that the U. S. Shipping Board intends to cancel all contracts with Californian yards where the keels have not already been laid, a mass-meeting was held at the civic auditorium in San Francisco on April 30, attended by shipbuilders, labor-union officials, public officials, and other interested citizens. An organization was effected with P. S. Teller, chairman; R. W. Burton, vice-chairman; and H. S. Robinson, secretary.

A summary of the situation, prepared by George Armes, president of the Moore Shipbuilding Co., and approved by the shipbuilding companies affected, was read at the meeting. The principal points brought out in this statement were as follows:

The threatened cancellations would affect 87 vessels in Californian yards, with a total deadweight capacity of 791,300 tons. The average amount expended on these vessels to date is $100 per ton, very little of which has been for labor, nearly all of it being for materials now on the ground or in process of shipment. These materials are mainly plates and shapes of special sizes unsuitable for any but the particular type of vessel for which they were prepared. The salvage on this steel would necessarily be low, and the same is true of other materials. The total estimated salvage is about $20 per ton, making a net loss of $80 per ton if the contracts are cancelled. The estimated cost of completing these vessels is $90 per ton, about 95% of which would be labor. The estimated minimum selling price of these vessels is $150 per ton, leaving a net loss of only $40 per ton.

Turning to other aspects of the case, the yards affected employ about 80,000 men. Cancellation of contracts would throw 40,000 of these men out of work almost immediately, and inside of six months the working force at these yards would be reduced to about 6000 men. By that time it is possible that sufficient private work might be obtained to prevent further reductions in force. All Government agencies are urging special efforts at this time to prevent unemployment. Of the 27,000 soldiers and sailors thus far demobilized in California, 10,000 are now working in the shipyards, and work can be provided for 5000 more if these contracts are not cancelled. Relief for the situation cannot be obtained, as is proposed, by simply allowing the yards to take outside contracts. Since the armistice, American shipyards have been compelled by the Government to turn down foreign contracts for 3,000,000 deadweight tons of ships. Arrangements for these ships have been made elsewhere and that chance is now past. American shipowners are in no position to contract for ships at the present time, nor will they be until the general policy for an American merchant marine is definitely settled. Furthermore, the contracts that it is proposed shall be cancelled contain no provision for cancellation except through default of the builder.

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Application of the Sand-Blast to General Foundry Work—Part II

By H. D. GATES*

THIS is the second of Mr. Gates' two articles on sand-blast equipment. Part I, which appeared in the April number, discussed the general question of cleaning castings, and described the various types of hose machines. The present article deals with the barrel, cabinet, and table types of sand-blast equipment.

WHERE the output of the foundry does not include work larger than may be loaded on half of a 90-in. diam. table, the hygienic table-cabinet offers the ideal equipment (Fig. 5). This cabinet is semi-circular, having an opening at the rear to permit revolving the table. The upright partition of the table closes the aperture entirely when the table is in blasting position, the same as in the room type. The semi-circular shape of the cabinet makes all parts of the table accessible to the operator, who observes the work through the sight-screen and directs the nozzle through the nozzle-slot. The work, as with the table in the room, is loaded from the outside by other workmen, permitting continuous sand-blast operation.

All the outfits described above provide for a sand-blast machine placed at the floor-level. Where limited area puts floor-space at a premium, the machine can be placed in a concrete hopper below the floor and the abrasive for re-use passed to the separator by gravity. This type eliminates the use of elevator and conveyor. General utility and ease of access requires the floor-level type where space will permit.

While the above hose-machine outfits will clean any and every character of work possible with any other type of sand-blast, it must be remembered that economy of cleaning with this device decreases with the size of the pieces, requiring added time and labor for individual handling.

For the plant that produces enough small work to warrant special equipment, the barrel sand-blast, or the rotary-table sand-blast, or both in combination, will be found time and money savers. Furthermore, their operation is entirely hygienic and relieves the operator from any contact with the dust-laden air.

The barrel sand-blast consists of a slowly revolving drum within a steel case, in which are placed sand-blast nozzles that blast the pieces as they are turned over, the construction of the drum being such that a constant turning of the load brings every surface under the action of the sand-blast nozzles. These units are self-contained, the spent abrasive falling through perforations in the drum and delivered to a hopper, from which it is raised by an elevator, cleaned and screened, and delivered automatically by gravity to the nozzles for re-use. In this type of barrel (Fig. 7) the interior of the drum is entirely unobstructed and it will receive pieces up to the limit of the door-opening size. Other barrels of the suc-

*Pangborn Corporation, Hagerstown, Maryland.

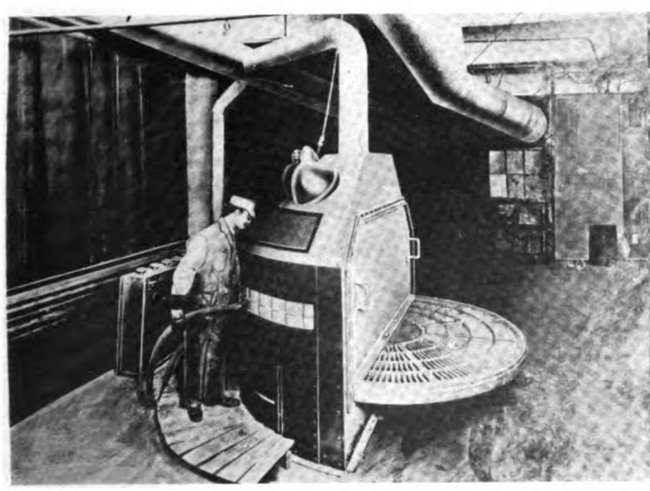

FIG. 5. TABLE CABINET TYPE OF SAND-BLAST

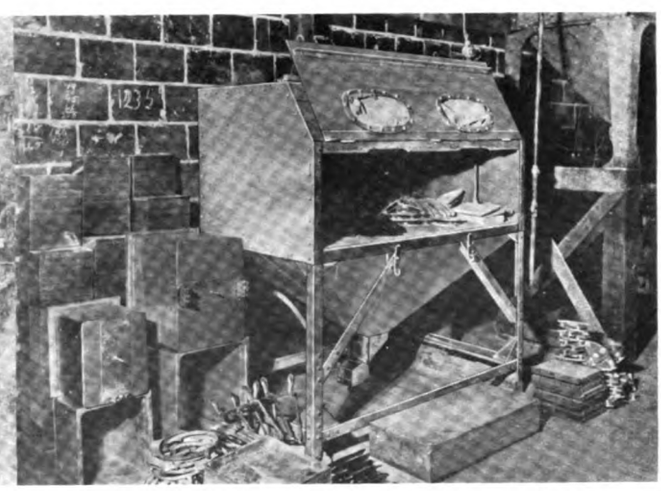

FIG. 6. CABINET TYPE OF SAND-BLAST

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tion type have a manifold running through the centre with a series of nozzles. As the abrasive falls through the drum-perforations it is passed through a series of screens to feed-boxes, from which it is raised by suction to the nozzle. Barrels of this type are more efficient for smaller pieces, such as valve-bodies and the like, from which they will remove the cores. Both types are made in several sizes so that the requirements of every plant can be accommodated. The drum rotates at a low speed so that square corners and ornamentations are not damaged.

For work of a fragile nature such as stove-plate, precision work, or pieces of shape and size that will not permit rolling within the barrel-drum, the automatic revolving-table sand-blast is of greatest utility. See Fig. 8. In this device a grated-top table is half exposed and half contained within a steel case wherein the blasting operation takes place. The opening at the front of the case to permit free passage of the castings is closed by multiple flexible sectional curtains that retain the flying abrasive and the dust produced during the passage of the work. The pieces are loaded on the exposed half of the table, and as they emerge from the blasting-chamber, are turned as may be necessary to bring all parts under the blasting action until they are thoroughly cleaned, when they are removed and new work loaded.

Multiple nozzles oscillate so that the pieces are blasted from all angles, the sides as well as the tops coming under the blasting action. These tables will handle material as fast as a man can load and unload it. The blast is of the direct-pressure type, the nozzles being fed from a direct-pressure hose-machine beside the table. Operation is continuous. The spent abrasive falls through the grated table-top, and is carried by an elevator to the abrasive-separator, which cleans the abrasive and delivers it to the sand-blast machine for re-loading.

Either or both of these devices can be used in combination with the sand-blast room, and ventilation can be provided for all in a single system.

All of the above devices while equally adaptable for the cleaning of brass and aluminum, as well as iron and steel, are of a size and capacity that is hardly warranted in the average brass-foundry. There is, however, as much advantage in cleaning of brass or aluminum castings with the sand-blast as in the ferrous metals, and cleaned on the gates means economy of time and labor with thoroughly cleaned scrap. For the small jobbing brass-foundry, a self-contained unit such as a sand-blast cabinet meets all requirements. The initial cost is not large, and the floor space required is small. Since the cabinet is of the suction type, and is self-contained and continuous feeding as well as hygienic, the operator is not exposed to the dust-laden air.

As the cabinets are simple of manipulation, they can be operated by boys or other unskilled labor. These machines are made in various types and sizes, the one shown in Fig. 6 being 3 ft. wide by 2 ft. deep with a door-opening 10 in. high. The pieces to be cleaned are laid on the grated floor of the cabinet. The operator handles the pieces through arm-holes equipped with rubber gloves and canvas gauntlets. He observes the work through a wire-and-glass covered opening provided for the purpose. Electric lights illuminate the inside of the cabinet. The blasting action is started and stopped by a single valve, which controls the air-flow. Cabinets are made with both stationary and flexible nozzles. In the larger sizes the nozzle is supported by an arm adjustable in all directions and reaching every part of the cabinet. With the stationary nozzle the pieces are turned under the blasting stream, while in the larger types with the adjustable arm, larger and heavier pieces can be cleaned, the nozzle being moved as required instead of turning the work. These cabinets are equally efficient on iron and steel castings, forgings, or stampings and are a desirable adjunct to foundries where a small quantity of delicate or precision work is done.

All of the above equipment, whether rooms, barrels, tables, or cabinets, must be ventilated for removal of the dust produced. This is accomplished by exhausters of various types, the disposal of the dust being accomplished as conditions may demand.

Where the plant is isolated and no detriment occasioned, the dust may be discharged into the open. There are few plants, however, in which either neighborhood or shop conditions do not demand some suppression of the created dust. The simplest arrangement is a settling-chamber with baffles that retain the heavier particles. Even this device is satisfactory only in widely separated plants, and where the operations of the foundry do not include machine work.

Where absolute suppression of the dust is not demanded, the centrifugal dry-process arrester has been found efficient. From 90 to 95% of the created dust is retained in the arrester and discharged through the bottom to a receptacle from which arrangement for removal can be made as desired. The lighter material, resembling a light haze or smoke, issues from the stack, which is capped to prevent the entrance of rain or snow.

Where, however, entire suppression of all dust is required the cloth-screen type of arrester is necessary. This is a steel case in which there is a series of specially woven cloth screens. The dust-laden air enters on one side, the screens retaining all dust and permitting passage of the cleaned air only which is drawn from the opposite side through the exhauster. A decided saving has been made in a great many plants through the use of this cleaned air, which, being warm, can be returned to the plant ventilating system or directly to the sand-blast room as conditions may warrant.

So effective are these arresters as to permit sand-blasting in large city office-buildings, and the diverting of the clean warm air to plant ventilating systems has effected a saving in fuel.

With progress in sand-blast equipment and methods has come also progress in abrasives. Various classes of sand are now mined and graded for sand-blast use. With the abrasive, as with the equipment, the better the quality the greater the economy and efficiency. Sands that are hard, sharp, and clean, with the least disintegration not only show longer life and higher abrasive quality but also create less dust. River or bank sands are rarely eco-

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nomical even if the first cost is low. Ocean sands are satisfactory, but the white silica-sands, where available, are the most desirable. Because of their hardness and uniformity they are economical even at a considerably higher first cost than other kinds.

Metal abrasives, such as chilled shot or crushed steel, are produced by different manufacturers, each making claims for superiority. Metal abrasives last from 20 to 60 times as long as sand. Disintegration is at the minimum and almost no dust is created from the metal abrasive itself. However, the much higher first cost calls for an absolutely tight enclosure throughout, as any loss, however small in amount per day, will soon wipe out the saving in efficiency.

The selection of sand or metal abrasive is dependent upon several factors. If the work to be cleaned is reasonably free from sand, considerable advantage in operating conditions will be found in the use of metal abrasives, owing to their causing practically no dust by their own disintegration, but if the work is cored or carries a large volume of sand the advantage from the metal abrasives will be greatly decreased. The dust produced by the disintegration of the blasting-sand itself will not materially increase the dust volume arising from the castings.

Where pieces are to be galvanized or plated, some complaint has been made against the metal abrasives because the fine metallic dust adhering to the pieces prevented satisfactory results in plating. For general foundry output, however, the character of the work itself, together with the cost delivered of the various abrasives will readily determine the economy of one over the other. All of the modern sand-blast devices operate with equal facility with either sand or the various metal abrasives.

One of the most frequent causes of unsatisfactory operation of the sand-blast is the presence of moisture in the air-line, which, if in sufficient volume to make the sand at all plastic will naturally prevent even steady flow, or, if metal abrasives are used, the mixture of moisture with the fine metallic dust frequently tends to rust the abrasive into a solid mass. Any device that will eliminate the moisture will be of decided advantage not only with the sand-blast but with all pneumatic tools. The Emergency Fleet Corporation in a recently issued 'Standard Practice Bulletin' describes a satisfactory device for this purpose as follows:

"It is the object of this communication to call attention to the importance of a second step, which should include provision for effectually separating and draining the water of condensation from the piping system.

"The water cannot be properly taken care of merely by placing drain cocks on low points in the ordinary piping system, but should be removed by special separating-tanks or chambers located at these points and near the distributing manifolds.

"The separating-chambers should be large enough to lower the velocity of the air to a point where entrained water or dirt will not be carried through with the air-current, and should be fitted with bafflers or connections which will change the direction of flow, so as to precipitate the entrained matter."

The live foundryman that investigates sand-blast equipment will notice results that are not commonly included in an inventory of sand-blast advantages. To the jobbing foundry producing castings that are to be machined, sand-blasting means the entire removal of the scale, which, on the contrary, is intensified by rumbling.

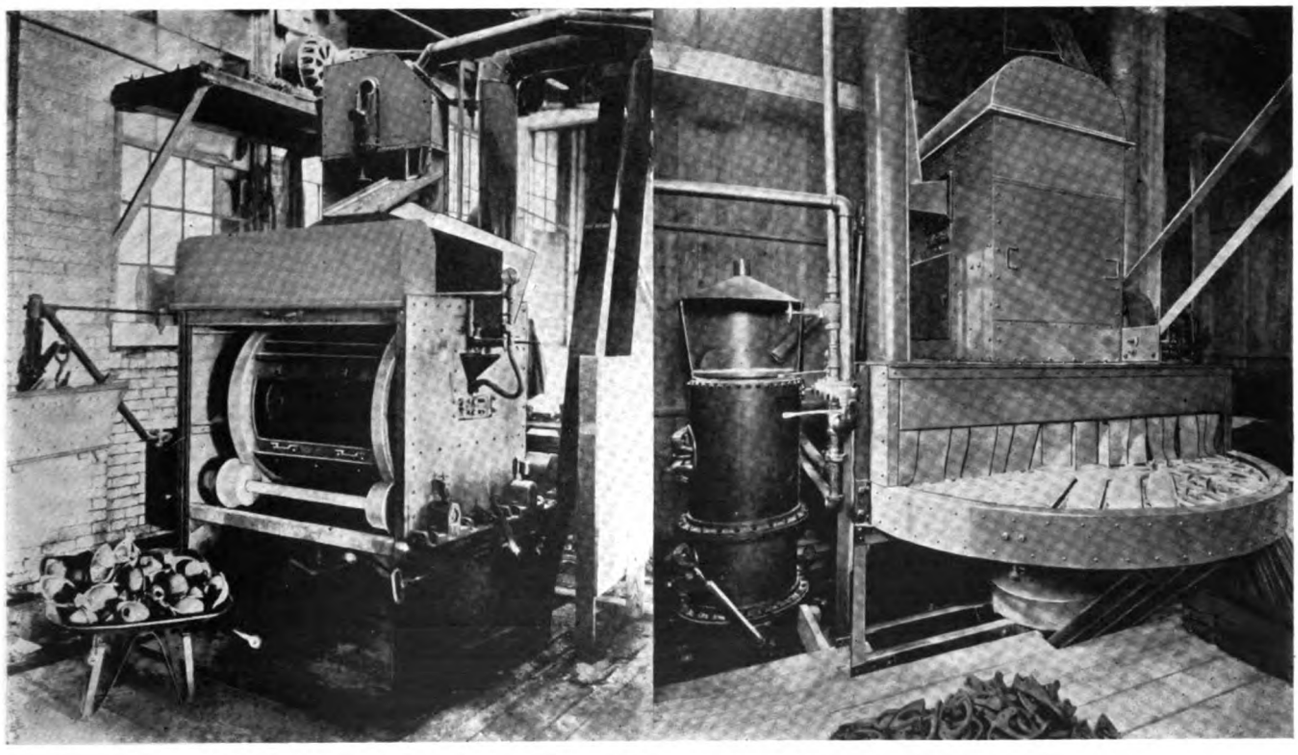

FIG. 7 AND 8. BARREL OUTFIT AND AUTOMATIC REVOLVING-TABLE OUTFIT

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The appearance of sand-blasted castings is much improved. Where castings are to be galvanized, painted, or plated, if they are thoroughly sand-blasted a surface is produced that ensures perfect results with the best finish, with a consequent saving in plating operations.

It should be realized, however, that like any other machinery, operating economy comes only through the selection, arrangement, and lay-out of the right devices for the conditions to be met and the work to be handled. Thorough discussion of needs and conditions with a responsible sand-blast manufacturer and taking advantage of his experience is needed for the best results.

The initial price of sand-blast equipment can hardly be considered an indication of its cost. Any outfit so complete as to get the greatest output at the lowest cost per ton means a daily saving, which, even if small, in time not only returns any increased cost over less efficient equipment but also wipes out the entire cost of the outfit, and becomes a money-maker, which will also ensure attractive castings and quick deliveries.

Electric Smelting of Low-Grade Manganese Ores

The U. S. Bureau of Mines has issued a bulletin of the 'War Minerals Investigation Series' on 'Electric Smelting of Domestic Manganese Ores', by H. W. Gillett and C. E. Williams. Blast-furnaces can economically use ores with an average content not much below 40% manganese and not much above 12% silica. However, there are large quantities in the United States and particularly in the West that contain a smaller proportion of manganese and a greater proportion of silica. There is a possibility of utilizing such ores by electric smelting. An electric-furnace plant can be constructed more rapidly than a blast-furnace. It can be operated economically in smaller units than a blast-furnace, and therefore can be placed wherever a suitable supply of ore and a suitable water-development are found near each other. An ore deposit inadequate to supply a modern blast-furnace would last a rather large electric-furnace for a considerable time. Hence the smaller electric unit can be so placed as to require smaller transportation charges than would be necessary for a more distant blast-furnace.

The product that could be economically made at such an electric-furnace plant would be not ferro-manganese but silico-manganese as this permits a much higher recovery of manganese. Silico-manganese is not used to any considerable extent in the United States but it is used in Europe. There is, however, a large quantity of steel made in this country in whose manufacture both ferro-manganese and ferro-silicon is used, and silico-manganese could just as well be used in this case. The utilization of ores low in manganese and high in silicon is therefore dependent upon the education of the steel industry to use silico-manganese where a combination of ferro-manganese and ferro-silicon is now employed.

New Standard Types of Vessels for the Emergency Fleet Corporation

The following standard designs are to be adopted by the Emergency Fleet Corporation for all its new work:

Group 1. A three-deck, shelter-deck, single-screw steel freight-steamer, 420 ft. over all; 405 ft. between perpendiculars; molded beam, 56 ft.; molded depth to shelter-deck, 36 ft. 9 in., with carrying capacity of 10,000 tons deadweight, and a draft of 26 ft., equipped with quadruple-expansion engines of approximately 4000 hp., and three Scotch boilers, oil burning, with steaming radius of 13,500 knots without bunkering.

This type of vessel is well known on the Pacific Coast, having been operated by Grace & Co. It is known as the Santa type and has given good service.

Group 2. A three-deck, shelter-deck, single-screw freight-steamer, 490 ft. over all; 470 ft. between perpendiculars; molded beam, 62 ft.; molded depth to shelter-deck, 43 ft., with carrying capacity of 12,500 tons deadweight, and a draft of 29 ft. 2 in., equipped with quadruple-expansion engines of approximately 5600 hp. and five Scotch boilers, oil-burning, with a steaming radius of 14,000 knots without bunkering.

Group 3. A three-deck, shelter-deck, steel freight-steamer,522 ft. over all; 500 ft. between perpendiculars; molded beam, 68 ft.; molded depth to shelter-deck, 45 ft. 6 in., with carrying capacity of 15,000 tons deadweight, and draft of 30 ft. 8 in. These vessels will be equipped either with twin-screw quadruple-expansion engines of approximately 6600 total horse-power or single-screw quadruple-expansion engines of approximately 6600 hp. and six Scotch boilers, oil-burning, with a steaming radius of 14,000 knots without bunkering.

Group 4. A three-deck, shelter-deck, twin-screw motor freight-vessel, 440 ft. over all; 425 ft. between perpendiculars; molded beam, 56 ft.; molded depth, 38 ft. to shelter-deck, with carrying capacity of 9800 tons deadweight, with draft of 26 ft., installed with twin-screw, 6-cylinder, 4-cycle Diesel-type engines, running at 100 revolutions per minute and developing 4000 hp. Steaming radius, 28,500 knots, without bunkering.

All the foregoing types are designed for a set-speed of 13 knots.

All boilers in the steamers to be same type and size, as follows: 15 ft. 6 in. inside diameter by 12 ft., built for 220 lb. working pressure and fitted wih forced draft and superheaters.

A MAGISTRATE was trying a prisoner for stealing. A medical witness was called, who said that, in his opinion, the accused was suffering from kleptomania, "and, your worship, of course you know what that is." "Yes," said the magistrate quietly, "it is what I am sent here to cure!"

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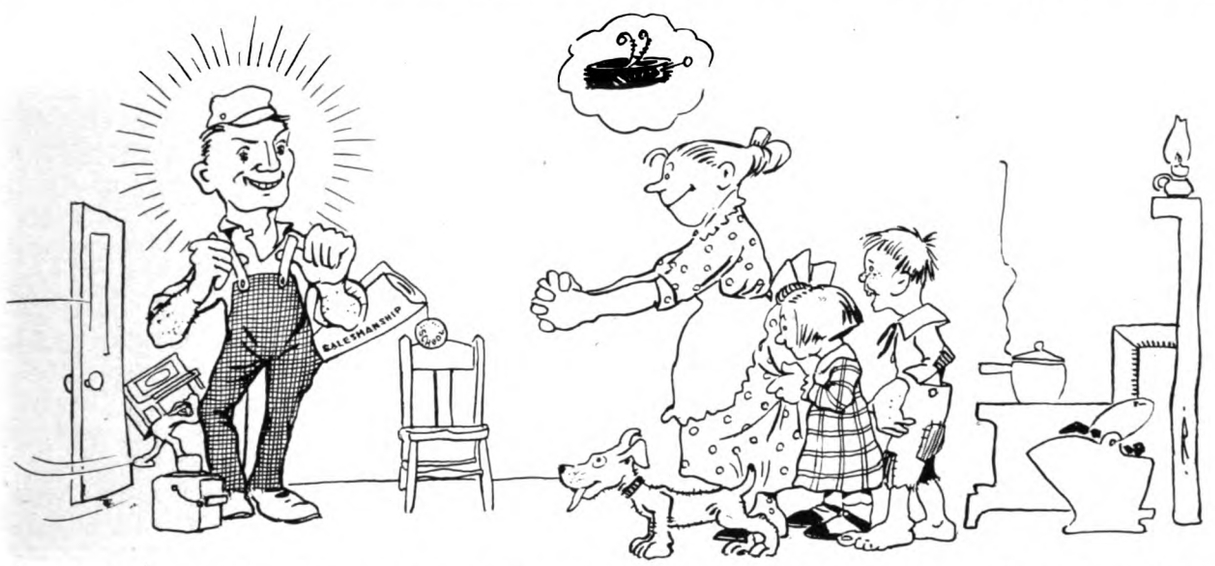
Selling: An Art

By Charles T. Hutchinson

Now that the War is over, all there is to do is to go out and sell everything we make. How simple it all sounds! What could be easier? Of course, it is generally deemed advisable to sell things at a price that will carry a profit to the seller, but even then, it is still simple. Just add whatever profit you would like to the cost, hire some salesmen, publish some catalogues, advertise, and, in the course of a short time, declare some dividends.

This is the idea that exists, in a more or less nebulous form, in the minds of a lot of people. The advertisements of various institutions of learning known as 'correspondence schools' depict the science of selling in its simplest form. There is the illustration of our hero, in overalls, with sleeves rolled up over brawny arms, bursting through the front door of his humble dwelling with expressive countenance registering simultaneously joy, pride, and exultation. He is greeted by friend wife with outstretched arms, her expression a reflex of the ditto joy, pride, and exultation. She is clad in apron and the customary other details. She has been preparing the 'pork and', against the homecoming of her liege lord. Two or more, as the case might be, of their offspring are clinging to their mother's apron, gazing with rapt visage upon their dad. It is easy to learn by the illustration that dad has done something big. Then comes the dialogue.



He. Oh, Abigail, what do you suppose has done gone and happened. The Boss called me into his office today, and said "Hector, my boy, entirely without your knowledge, I have had my eye on you these past forty years, and when I saw the lessons from the R. S. V. P. Correspondence Schools sticking out of your trousers pocket, I said to myself, 'Ecce homo', which means that from now on you are no longer a boiler-makers helper, but General Manager of Sales at a salary of umpty-steen bright golden ducats per annum."

She. Hector, my king, my prince! Now I can have a new hat that will make that odious Mrs. Smith green with envy!

Joy, wassail, finis!

Finis, that is where the trouble comes in. It is not disclosed, now that Hector has got the job, whether or not he held the job, and for how long. These advertising stimuli end just like a popular novel, when the hero is married to the job, but whether they both lived together happily forever after is left to the imagination of the reader. Neither 'ad.' nor fiction writer sees romance or poetry in the divorce court.

Without being unduly cynical, we prophesy trouble ahead for Hector, unless his training has been much more varied and comprehensive than that offered by any correspondence school, excellent as many of them undoubtedly are. A correspondence course in selling, or any other course of study through books, is as the ABC's to a Doctor's degree in literature.

Selling involves not merely a mastery of the science of organization, but a profound knowledge of the Book of Life itself, a knowledge that can only be acquired by omnivorous reading, acute observation, and an analytical mind, by which apparently insignificant facts and tend-

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encies of the human race may be dissected, ticketed, labeled, and made to reveal the ideas, desires, and longings of that impossible creature known as the average man, or woman.

Take all of the gainful occupations, compile a mass of statistics out of which may be determined the average compensation per individual for each, and it will be found that the profession of selling—or business of selling, if you like—is the most highly paid of all. Thus is proved by the reductio ad dollar method that selling is the most difficult of them all.

It is not the purpose of this article to enter into a discussion of the minutiae of selling, the methods of organization, the canvassing of the field, the compilation of statistics, the preparation of an advertising campaign, the territorial maps, or the hiring and firing of salesmen. These things constitute the machinery, the plant equipment, the inanimate forces of selling. What are much more interesting are the more delicate shades and factors that influence and often control sales; these are about to be brought under the microscope, so that those who read will understand and sympathize with the problems of the salesman, the difficulty in his making good, and his large and toothsome pay-check if he does.

Jones, the star salesman for the Alpha Beta Manufacturing Company, has just returned from New York. His entry into the office takes upon itself the nature of a triumphal procession. Everybody grins, the proletariat

in the outer office with envy, the Boss himself with congratulation tinged with relief. The strain has been a severe one, even those not in the confidence of the management knew that work in the shop was slack, and that a whole season's output hinged upon the success of Jones' mission, and, Jones landed the contract. Now he is home, the contract itself, all signed up by Presidents and Secretaries and things, together with what was most important, a nice fat check for the first payment, are about to be extracted from the well-worn leather brief-case and spread on the mahogany table before the admiring gaze of the Boss.

Let us sneak into the private office before the door is closed and listen to Jones as he reports the intimate details of just how it all happened.

"Now Jonesy, old boy, have a cigar, and sit down and rest yourself for a while," said the Boss with a happy smile. The cigar was produced, from a special box covered with revenue stamps. That was some cigar. "Have a light, Jones. You will find that other chair more comfortable." Jones puffs away for a minute. It is his minute, and he is enjoying it hugely.

"Well, sir," replies our hero, after gazing rumina-

tively at the accumulating ash, "the real history of that interesting typed document which you see before you dates back a good long while. You remember the old

yarn about the pig that started the war, and the cow that kicked over the lamp that set fire to Chicago? This par-

ticular job is very much the same sort of thing.

"When that Scotchman came in with the design for

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the particular piece of apparatus which is now the backbone of the business, you may remember that the office-boy, like most office-boys, happened to have a grouch, and was just going to tell him that you were not in, or something, when you came out of the office-door and stopped long enough to look at what the Scotchman had, became interested, and the result was that he was given a job in the shop and is now our general superintendent. That little appliance was so good that it is now our best feature. So, you see, that is where this particular contract really started. In other words, if our stuff wasn't right, all the salesmen in the world wouldn't have done one bit of good in this case, or any other.

"Then another thing. You remember that habit of yours, pinning the envelopes on letters after they are opened instead of chucking them in the basket? That is another factor in getting this job. You will see why as the story unfolds.

"A third factor is a bit of elementary psychology, based upon the tendency of the human mind to want something immediately if told that it can't have it.

"The fourth factor is the efficiency of the modern telephone; the fifth lies in the fact that you made me fighting mad with those confounded telegrams of yours; and the sixth, and perhaps the most important one of all, lies in the element of luck, without which we might have been thoroughly licked in spite of ourselves.

"I landed in the big city on time, for a wonder, and, as soon as I had been wafted to my hall-bedroom at the Splitmore, after running the gauntlet of piratical taxi-drivers, door-men in general's uniforms, bell-hops, and other automatic coin-collectors, I sat me down to the writing-desk and wrote a line to the president of the company with whom we had been corresponding to let him know that I was in town and wanted to see him."

"Why didn't you go to see him, or call him on the phone?" asked the Boss.

"Because the only address I had was a post-office box number," replied Jones. "You remember that the property where the stuff is to be used is in Montana, and I hoped that they would have a regular office in the city. A diligent search through the telephone books, and also some sixteen directories didn't help me a bit, so there was only one thing to do, and that was to drop him a line; so I did.

"The next two days slipped by like nothing. I tried to round up some other prospects, but there was nothing doing. The weather was infernally hot, so all the natives who had the price were at the seashore, and those who hadn't didn't interest me at all.

"Then you started those confounded telegrams. How would you like to be sweltering away in a big city, thousands of miles away from home, and doing your darnedest, and then get something like this, 'If you don't land that job, this place will be shut down when you come back', or 'Make a noise like an order or stay in the East permanently'? Maybe you think I wasn't mad. I was determined to land that job or bust, and then wire you to go chase yourself forever, as far as I was concerned. I suppose all you really wanted was to arouse the fighting spirit; anyway, you certainly did."

"You will have to forgive me for the rough stuff, Jones," grinned the Boss. "Anyway, it was good medicine. It worked."

"All right," laughed Jones, "I am so darned good-natured now, that I don't care. But to resume. Two days, three days, and then four days passed, and I didn't hear a single word from him. I kept getting more and more nervous, until finally, one evening I was sitting in my room scratching my head in a vain effort to start an idea of some kind, when I went to my grip and absent-mindedly took out all the correspondence dealing with the case. Turning it over, I noticed a letter with an envelope pinned on. By Jingo: what do you think? The postmark was New Brunswick, New Jersey. That fellow must have been in New Jersey, in fact, must be staying there, perhaps with relatives.

"I grabbed the telephone, and soon was communing with the operator in my most honeyed tones, somewhat in this strain. 'Please, oh please, call New Brunswick, New Jersey. Then, ask the telephone operator if, by any happy chance she knows of a Montana mining man, who has planted his whereabouts in that beautiful suburb, and further, if said mining man perhaps is so situated as to be accessible to the telephone.' Then followed many objurgations as to the great and vital importance of this matter. After that down I sat, to possess my soul in patience, and wait, and fume.

"Half an hour passed to the great beyond. Then another half-hour. Then tinkle-tinkle went the bell. I jumped for the phone. Here is the way I got it.

"'Th' party you want is atta farm 'bout fi' miles out. D' you wantum?'"

"Did I want him? I wonder. By the great horn spoon, he was on the wire in less than five minutes—so fast that, at first, I was almost tongue-tied. However, I soon got going, and told him what I wanted in good vigorous English too. He was most indifferent, in fact, he practically said he didn't care a hang whether he saw me or not, and wasn't ready to talk business anyway. Then he hung up the phone.

"I was sick, just sick over it. And the worst part of it was, that there didn't seem to be anything to do about

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it. Anyway, I turned in, and tried to get some sleep in the hope that some new hunch would appear in the morning.

"That was tough," remarked the Boss.

"You know it," returned Jones, with emphasis. "Well, next morning about seven, while I was dressing, my 'phone rang, and there he was again. To my surprise, and delight, he said that he didn't just get who I was over the 'phone the night before, and he had just received my note, and would try to get into town before I left. He explained further that his partner was in England trying to float bonds to raise the money needed, and that, until he came home, there would be nothing doing. We chatted pleasantly enough, and I hung up the 'phone with a heavy heart, and prepared to start for home in two days.

"I cleaned up the few odds and ends remaining, and, on the morning of the day I was to leave, I called him again, just for a spec. By jingo! he had received a wireless from his partner that day. The money was raised and the ship his partner was on would dock that day at noon. Well, you know about the drowning man and the straw. I stood up on my hind legs, and simply burned up that telephone wire. Told him that he must, MUST, MUST, meet me that afternoon, and finally I simply talked him into consenting. He was to show up at two o'clock, and bring his partner.

"At two, I was pacing the lobby. At three I was running around the lobby. At four, I was gasping for breath, my glazed eyes indicating that all was lost. At four fifteen, in they came. Do you know, I bet they don't know yet what happened to them. I had a head of steam on way above the safety mark, and, as soon as they got into my room I went after them. You see, I had to get this job signed up before they had a chance to see any of the other fellows, and I didn't let any grass grow under my feet.

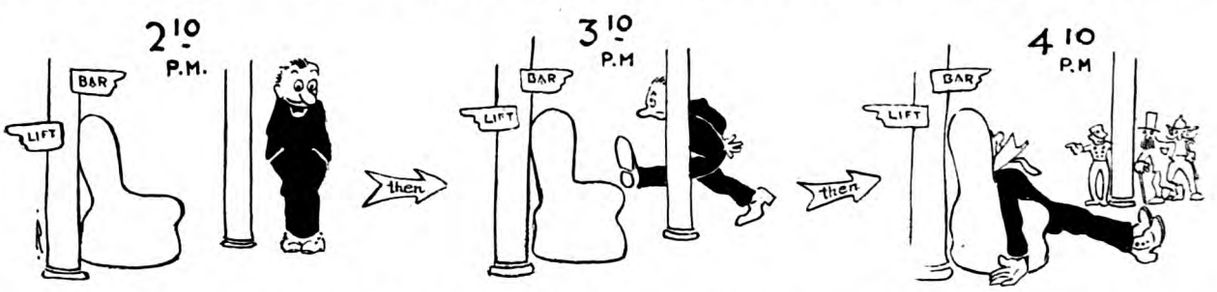
"They bucked, and bucked. The book of a thousand excuses was completely used up, and the final clincher, was simply this: that the prices I had quoted were based upon that bargain-sale lot of brass you picked up, and if they didn't take advantage of the offer within an hour, all prices would be immediately withdrawn, and they would lose thousands of dollars by their procrastination.

"That was a clincher. Finally, he turned to his partner and said: 'Waal, Jimmy, what do you say? Shall we buy?' 'Might as well, Hank,' drawled the partner; and buy they did. The fountain pen was produced, everything was signed, sealed, and delivered, check and all; and, to cap the climax, when I suggested that it had been dry work for all of us, the partner looked at me sadly, and said: 'Me and Hank don't never touch a drop, and, young man, you would be a sight better off

if you didn't nuther.' They blew, and I collapsed in a chair."

Large organizations, international in their scope, go to great lengths in the compilation of individual statistical data on prospective buyers. Such matter is prepared carefully and painstakingly from a great many sources of information, and is elaborately card-indexed for ready reference in case of emergency. The methods are, in some cases, strikingly similar to those observed by criminal identification bureaus. Everything about the man, save his thumb-prints, photograph, and Bertillion measurements are available.

Here is the way it operates. Suppose the word is passed along that one Snodgrass, chief engineer for a great corporation, is about to collect data dealing with the proposed installation of a great plant-addition involving the purchase of vast quantities of apparatus and supplies. The scouts for the supply-houses and manufacturers know this long before any inkling appears in the daily press. Instantly the great general staff of the manufacturer clears decks for action. Interest centres on Snodgrass as the man who will in all probability be a big factor, if not perhaps the final factor, who will say yes or no as to who shall get the business.



Resort is first had to his dossier. There are disclosed all sorts of interesting facts. He is dissected, analyzed, and laid on the table under the microscope of the general staff, which is about to plan the campaign that will ultimately result in victory for their forces. Let us look over their shoulders and learn a thing or two about Snodgrass.

We find that Snodgrass is 49 years old, where he was born, full particulars as to his scholastic training, the name of his alma mater, the courses he took, and whether he went in for athletics or other forms of activity en-

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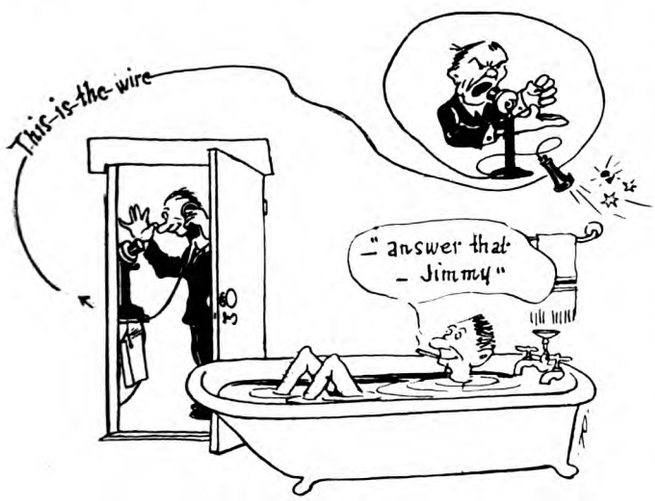
gaged in by the student body, whether he was a 'barb', or perhaps a member of the exclusive Alfalfa Delts, Eta Bita Pi's, or Moo Moo Cows. Then comes his professional record, the names of his former employers in chronological order, his engineering society affiliations, and his clubs. His professional fads are disclosed by his contributions to the engineering society proceedings or the technical journals, his social affiliations by his clubs. Then comes data as to his family, and hardly less important, the social activities, fads, and fancies of his wife. Under the heading of remarks, we learn that Snodgrass has a marked aversion to salesmen, likes to drive a high-powered car, suffers from indigestion, is a teetotaler, quick-tempered, plays golf for exercise, and hates like thunder to lose, is amenable to flattery if tactfully applied, in short is what is known in selling parlance as an all around hard case, but, to use another salesman's axiom, the higher they are, the harder they fall.

Pursuing the work of the general staff a little farther, Snodgrass' assistants are also smoked out with the same infinite care. Their influence and power of suggestion are not overlooked. Then various dignitaries are set to work on the job, each with a definite assignment, and the entire strength of the business Wilhelmstrasse is turned loose on the most interesting big-game hunt known to the commercial world. Of course, there are many of such campaigns under way continuously, but this, in brief, is the modus operandi. From the time of its inception to its consummation, one way or the other, the iron is kept hot at all times. Frequently the period of negotiation may represent years. Sometimes, there will be several flare-ups and die-downs before the deal is consummated, but it is a case of eternal vigilance, and Heaven help the salesman who is caught napping. His reputation and his job hang in the balance.

Competition is keen, and rivalries are intense. Out of it come many amusing contretemps, of which the following is an example: A salesman, who had been following up a prospect on a big contract for some time, succeeded in establishing himself on such a firm personal footing with the buyer, that, when the buyer went to New York, the salesman met him at the station by prearranged plan, and accompanied him to his hotel. The buyer adjourned to the bath-room to remove the stains of travel, leaving the salesman to amuse himself in the bedroom meanwhile. The buyer safely in the tub, the telephone rang. "Answer that, Jimmy," came the orders from the tub. Jimmy did. It was the chief salesman of Jimmy's bitterest rival, and, then and there, over the phone that salesman, thinking that he was addressing the buyer, proceeded to rip Jimmy up the back, his concern up the back, and his goods up the same place. Then forthwith, when the salesman paused for breath, Jimmy took a hand, and, impersonating the buyer, proceeded to read the salesman a lecture on the fallacy of knocking one's competitor, decency in sales tactics, and other things in such plain, vigorous United States, that said salesman disappeared from human ken when the story got out, as such stories always do, and Jimmy got the job hands-down.



In the use to which such personal data on individuals is put, is involved the necessity of consummate skill and an infinite amount of tact. Many a good sale is lost, and a permanent prejudice established through a lack of appreciation of these facts. The amour propre of the buyer must be carefully observed, that it be not bruised or ruffled by overzealousness.

A buyer, who had the placing of a large amount of business every year, had occasion to go East at one time, and, of course, the scouts of a certain business concern duly apprised their principals of the fact, together with the usual data as to the time of his arrival in the big city, his favorite hotel, and the kind of hospitality which, they thought, would appeal to him. As this particular concern had fared rather ill at the hands of this buyer, they thought to grab this golden opportunity with both hands, and unfortunately overdid it badly.

When the buyer arrived, he was met by the genial type of spellbinder, who, willy-nilly whisked the buyer and his grips into a limousine de luxe and shunted him into his hotel, had a whole procession of bell-hops and things rush out to meet him and conduct him into a Louis Kansas suite which looked like $50 per day, filled his key-box with cards to clubs, kept the telephone tinkling constantly with theatre invitations while the poor buyer was trying to take a bath, and generally made an infernal nuisance of himself. As a result, the buyer, as soon as his entertainer vouchsafed to leave him for a minute, quietly sneaked out of the hotel and went to a friends' home and took with him a contempt and disgust for that particular concern which has lasted to this day.

Contrast this with the adventure of a certain well-know master salesman for a steel manufacturer. There was a big deal on for certain steel products with a foreign country. Millions were involved. After much scurrying around, the master salesman met the visiting foreign delegation at Sandy Hook, with the assistance of a sea-going tug, and, before the vessel docked, he was in possession of the whole circus. He had spent much time studying up the characteristics of the people with

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whom he was to deal, and, in consequence, his conduct to them was a model of suavity, diplomacy, and finesse. The visitors were charmed to find, in one supposed to belong to an uncouth race, the model of a gentleman of their own standards.

That night, the inevitable dinner was arranged in a private dining-room of a great hotel. The hostelry, given carte blanche in every particular, outdid itself. Rare exotics adorned the festal board. The silver and table appointments would have graced the table of the Czar himself, while spotless napery added the final touch to what was to be a gastronomic masterpiece.

Enter the visiting foreign delegation, resplendent in uniforms such as were only possible in the old world under the ancient regime. Gold lace, orders, decorations, medals, and monocles; fiercely waxed upturned mustaches and clanking sabres, there was the very breath of romance, the real Prisoner of Zenda atmosphere. Of course, there were toasts, drunk in hollow-stemmed glasses filled with rare vintages. The senior officer among those present proposed "His Imperial Majesty, the Czar." In a flash, all were on their feet. Heels clicked, sabres flashed aloft. "The Czar." Crash! Every glass went smash against the wall.

Then comes the master salesman. "Gentlemen," he said. "I long have admired the delightful custom of your country, that prevents the profanation of any glass after dedicating it to the sacred health of his Imperial Majesty. Now, I will show you how it is done in these United States. Gentlemen, his Excellency the President of the United States." All rose. Again the click of heels, the flash of sabres, and glasses aloft. No sooner drunk, than the master salesman seized the table-cloth, and with one sweep of his arm, one mighty crash, threw everything on the table to the floor.

Then pandemonium broke loose. Floor clerks, house detectives, bell-hops, and sundry other fauna that infest the halls and corridors of great hostelries, galvanized into action, rushed frantically about. Cheer upon cheer rose through the smoke-laden air and impinged upon the ceiling, scaring the life out of the old ladies on the next floor. Such magnificence, such lofty contempt for expense! Thousands of dollars worth of gorgeous cut-glass smashed to bits in honor of the President of the United States! This great man, this superb American, with his dramatic appeal to the imagination of the most temperamental people in the world, held the situation in the hollow of his hand. What chance did the poor plodder, the spectacled master of blueprints, specifications, and tests stand? Where, Oh where, were the efficiency engineer, the advertising manager, and the correspondence school-graduates? Who got the order? How can you ask?

Shipbuilding in China*

At Shanghai there are three modern shipbuilding companies, the Shanghai Dock & Engineering Co., Ltd., the New Engineering & Shipbuilding Works, and the Kiangnan Dock & Engineering Works. The Shanghai Dock & Engineering Co., Ltd., was founded about 1860 by two American shipwrights, S. C. Farnham and C. P. Blethen under the name of S. C. Farnham & Co. The present name of the company was adopted in 1906. The company has three shipyards, five drydocks, the largest being 532 ft. long with 24 ft. of water on the sill, and slipway for small vessels. The total area of the works is 96 acres. The company recently built a 6000-ton collier for the Quartermaster Department at Manila.

The New Engineering & Shipbuilding Works owns two shipyards and a drydock, the total area of the works being 17 acres. Vessels up to 3400 tons capacity have been built there.

The Kiangnan Dock & Engineering Works was originally organized to build ships exclusively for the Chinese government, but for the past 14 years has done a commercial business also. The company is now building four 10,000-ton freighters for the U. S. Shipping Board.

At Hongkong, the principal shipbuilding companies are the Hongkong & Whampoa Dock Co. and the Taikoo Dockyard & Engineering Co. There are also several small yards owned and operated by Chinese. At Canton there are several small yards where modern ships and engines are constructed.

*Abstract from 'The Far Eastern Review'.

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Fire Prevention in the Metal Trades—Part I

By R. E. SWEARINGEN

THIS is the first of two articles by Mr. Swearingen, and deals mainly with the ordinary and special fire hazards in the metal trades. The second article, which will appear in the June number will discuss methods of eliminating many of the hazards by better construction. Mr. Swearingen is engineer for the Fire Prevention Bureau of the Pacific.

THE steadily increasing fire waste of this country is a matter of importance to every citizen, for it is an economic loss and constitutes a serious handicap in our race for world trade. In the past, our seemingly unlimited national resources have enabled us to absorb this loss without much effort. We now realize that our national resources are limited and that national conservation is necessary. Allowing three hundred million dollars worth of property to be destroyed by fire yearly is one of our most pronounced forms of inefficiency. At the present rate of increase we shall soon see our annual fire bill mount to half a billion dollars, and then to a billion. If these figures represented expenditures for additional goods they would not appear large in this age when national expenditures involving billions are common. Our fire waste, however, represents a dead loss instead of additional wealth, as do ordinary expenditures.

Fire-prevention is one of the most important questions before us today. While it is of direct interest to the property-owner it is also of concern to the public at large. For years this subject has been receiving the attention of a few people but it is only recently that it has been given any serious thought by the public. One result of the War has been forcibly to call attention to the necessity of conservation of both natural resources and labor, and that our fire losses are, to a large extent, needless waste of both. Excessive fire losses occur in homes, stores, forests, factories, and every other form of industry. While the loss record in the metal trades is more favorable than many others it is much greater than it should be. In fact, if the differences in fire hazards is taken into account, fire losses in metal-working plants are as excessive as in any other industry.

Most fires are the result of carelessness, and the first and most important step in fire-prevention in any industrial plant is for every person connected therewith, from the president down, to observe ordinary care wherever fire hazards are involved. The feeling of personal responsibility to prevent fires should be developed in every employee. Conditions that might cause a fire, or aid in starting one, are usually called fire hazards. They are divided into two main classes, common and special. Common hazards are those which are found in all classes and occupancies, and include the hazards of lighting, heating, power, general upkeep, and the care of oils and refuse. Special hazards are those peculiar to certain classes and are due directly to the occupancy of special work carried on. The term special hazards does not necessarily refer to those that are extra hazardous, for often they are of less danger than the so-called common hazards. As a matter of fact, as many fires originate from common-hazard causes as from special hazards. Out of 818 fires in the metal trades of which I have a tabulated record, 51% were caused by common hazards.

In this article I will point out some of the more common causes of fires in these industries and will offer suggestions toward eliminating them as far as possible. It is obvious that only a few of the more important hazards can be covered, and these briefly.

Good housekeeping is the real foundation and the most important feature of fire-prevention. This is just as true in the metal trades as elsewhere. A clean well-managed plant is not only a safer risk, but a healthier and more satisfactory place to work in, and it has a decidedly wholesome effect on the working force. The manager that does not develop the idea of a clean factory is overlooking an opportunity, as well as neglecting a duty. The shop should be cleaned daily and oily rags and other combustible refuse burned in a furnace. Metal cans with self-closing covers should be provided for taking care of oily waste as it accumulates during the day. Except in special places, such as an ordinary foundry, smoking should be prohibited, and signs posted to that effect.

Electricity is the most common means of lighting our industrial plants. The hazards incident to its use cause many fires. A carefully installed electric-lighting system, however, will not cause a fire if properly maintained. To be safe, electric-lighting systems should be installed only by expert electricians and in accordance with the National Electrical Code. Extensions to old systems should be made in a similar manner, taking particular care to see that the extensions do not overload the original circuits. Fuses and circuit-breakers are the safety-valves of electric systems and only those of standard type and proper size should be used. One of the abuses often found with lighting circuits is the replacing of blown-out fuses with nails, wire, and other pieces of metal, which the employee in charge finds more con-

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venient to use than a new fuse. Portable and pendant lamp-cords are a frequent cause of fire. Making extensions out of ordinary pendant cords is usually accompanied by wrapping them around iron pipes, tying on nails, and other abuses that are likely to wear out the insulation and cause trouble. Paper lamp-shades should be condemned. Where volatile vapors are present, as in the oil-room, only vapor-proof globes should be used. All electric systems should be regularly inspected by competent electricians.

Gas-lighting of industrial plants is becoming almost obsolete and the fire hazard is not great. The principal precautions to be observed with gas-lighting systems are to maintain the piping in good condition, keep open gas-flames away from combustible material, and provide a gas shut-off valve outside of every building. Swinging gas-brackets should not be used. If acetylene gas is used, the generator should be of standard type, and be placed in a detached building. Acetylene installations should be under the supervision of an employee thoroughly familiar with the operation of the generator, and all details of the system. Calcium carbide should be kept in water-tight metal cans in a detached building.

On account of our mild climate on the Pacific Coast, particularly in California, the heating of metal-working plants is a simple problem, but because the heating devices need be seldom used, they are often of a make-shift type and consequently dangerous. The safest method of heating is by steam, or steam-heated hot-air blower-systems, in which case the most important precaution to be observed is to see that the steam-pipes are clear of woodwork, and other combustible material. Many types of gas radiators are in use. They should always be connected with solid metal piping. Rubber gas-connections are dangerous. Electric heaters are often suitable for small rooms. When properly installed they are fairly safe. Kerosene heaters are the cause of many fires and are not recommended for general use. Ordinary coal and wood stoves should be connected to well-constructed brick chimneys and the floor beneath the stove and all surrounding woodwork, ceilings, and partitions should be well-insulated. If the back of the hand cannot be comfortably held on all woodwork exposed to heat from stoves and flues, conditions are unsafe. Metal alone is not a heat-insulator; an air-space should be allowed between the sheet metal and the woodwork to be protected.

The position and arrangement of power generating and distributing equipment is one of the most important features to be considered from a fire-prevention standpoint as the continuous operation of the shop is dependent upon the power plant. Electric power from a detached plant is the safest, for it eliminates the boiler hazards. The same precautions should be observed with electric-power as with electric-lighting equipment. Motors should be placed in clean, dry, well-lighted, and accessible positions.

When steam power is used, it is desirable to place the boilers in a detached building when possible. When this is not feasible the boiler-house should be cut off from the main part of the plant by means of a good fire-wall. In any case, unless the boiler-house be of fireproof construction throughout, ample clearance must be provided between the boiler, breeching, and stock, and all combustible walls, roofs, and partitions. It is also preferable to have engines and electric-generating equipment in rooms separate from the boilers.

The storage and handling of fuel for power-plants always involve a certain amount of fire hazard. Fuel-oil should be stored in outside underground steel tanks, properly vented. Air-pressure, or gravity-feed systems from the main supply-tanks should be discouraged. The use of coal for fuel is often accompanied by a spontaneous combustion hazard, for most kinds of bituminous coal are subject to this danger under certain conditions. Fine coal is more susceptible to spontaneous combustion than lump coal. Coal should be piled to moderate heights, particularly if a large proportion of screenings be present. It should never be piled against or around woodwork, steam-pipes, sewer-manholes, on the brick side of a furnace, or any other form of heating device.

The main supply of oils and paints should be stored in a well-detached oil-house, preferably of fireproofing construction. Mineral oils alone are not subject to spontaneous combustion, but some vegetable oils are usually found in metal-working shops. Sawdust should never be used to catch oil drippings. If gasoline is used in large quantities it should be stored in outside underground steel tanks. Small quantities for use in buildings should be kept in approved safety-cans.

Turning to special hazards, the principal one in a foundry is around the cupola due to sparks on nearby roofs, or to excessive heat igniting woodwork. To reduce the hazard, all nearby roofs should be covered with non-inflammable material; the cupola loading-platform should be of iron or concrete, the latter preferred because it affords better footing for the workmen; the floor under the cupola should be of earth or concrete; there should be no woodwork near the cupola, particularly where it passes through the roof. At this point a clear space of at least two feet should be provided. The best arrangement is to place the cupola in a fireproof wing.

Wooden flasks should be stored in the yard or in detached sheds, and never on the roof or against wooden walls. The charred wood of the flasks often smoulders after the sand is removed and then bursts into flame. All core-ovens, mufflers, and similar furnaces should be constructed of brick with good clearance to all combustible material, such as ceilings, walls, and posts. Chimneys should preferably be of brick, and if of metal should have at least 24 in. clear space between them and any woodwork.

Most foundries have a pattern-making department. The principal special hazard is in the disposal of shavings and refuse. If there is any considerable amount of planing and other machine woodworking, all machines should be connected to an approved blower-system for conveying refuse to a vault in the boiler-house, where it

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should be burned. If there is a dry-kiln on the premises it should be well detached, and should be heated by an approved steam or hot-air system. Dry boxes should be lined with asbestos and metal, and heated by properly supported steam-pipes. Glue-pots are preferably heated by steam; if by electricity the electric connections should be made in a standard manner, including a pilot-light to show when the circuit is closed. Finished patterns should be stored in separate buildings of good construction.

The chief hazards in machine-shops are in the care of lubricating and cutting oils, and in the care and disposal of oily waste. Automatic machine-tools using a soap or soda compound for cutting are far less hazardous than those using oil. It is desirable to set machine-tools using oil on metal bases with curbed edges to collect the oil and keep it off the floor. The use of benzine or gasoline for cleaning machinery should be prohibited. Oily steel chips have been known to ignite spontaneously and should therefore be safely disposed of.

In forge-shops floors under forges and anvils should be kept in good repair and protected with sheet-metal. An earth or a cement floor is preferable. Forges should be provided with metal hoods and vents to take away the hot gases. Large furnaces for heating plates and similar bulky material should be well constructed of brick with brick or metal stacks. Ample clearance to all woodwork should be maintained.

The principal hazard in sheet-metal works is in the soldering processes. Soldering-irons should preferably be heated by sub-standard gas-furnaces with rigid metal gas-connections. The benches on which the furnaces are placed should be well protected.

Any buffing process where the wheel is of a fibrous substance and an oily substance is used on the wheel is hazardous because of the danger of spontaneous combustion. Buffing-wheels should be connected to a tight well-constructed metal-pipe blower-system, so as to keep benches and floor as free from lint and dust as possible. The blower-system should discharge into a detached shed or vault. If the dust must be saved, the cyclone can discharge into a metal-lined box half filled with water.

Japanning, lacquering, and enameling processes introduce a severe fire hazard, and if possible, should be carried on in a detached building so as to isolate the danger. The hazard is greatest when the material being finished is dipped in a japan or enamel thinned with a volatile combustible such as benzine or turpentine. When dip-tanks are used they should be made of metal, and equipped with overflow-pipes and automatic covers. The main supply of japan, paint, benzine, etc., should be stored in a detached vault and brought into the japanning room only as needed and not more than a day's supply at a time. Ovens or driers should be constructed of non-combustible material, and well ventilated. Steam heat is by far the safest, for an open flame is likely to ignite the vapor from the benzine or other thinning compound.

Steel-hull shipbuilding plants include foundry, machine-shop, forge-shop, boiler-shop, riveting, welding, sheet-metal working and other metal-working processes with the usual fire hazards, none of which are normally heavy. Considerable woodworking is usually done in the carpenter and joiner shops, mold-loft, etc. The most common cause of fires, at least in the Californian yards, has been the oil-fired rivet-heating forges. Most of these, however, have recently been replaced with gas-heaters, which are much more satisfactory from a fire-hazard standpoint.

The prevention of unnecessary loss by fire in our industrial plants requires not only the elimination of fire causes but also construction which will retard the spread of a fire, and the necessary means to extinguish a fire should one start. Fire protection and construction in the metal trades will be discussed in a concluding article

Practical Limits to the Size of Diesel-Engine Units

An article in 'Motorship' on 'Diesel-Electric Drive for Motorship Propulsion', by G. C. Davison, discusses also the general limitations on the size of single units. Economical piston-speed is placed at 600 to 700 ft. per minute for stationary slow-speed engines with 1200 ft. per minute as the upper limit for light-weight high-speed engines. The recommended speed for ordinary Diesel engines is 900 ft. per minute. As regards size of cylinders, the labor cost per horse-power for small cylinders is so high as to be prohibitive. On the other end of the scale, since the weight per horse-power varies directly with the diameter, the cost of material for large-cylinder engines becomes very high. The following table, based on a particular type of engine, shows approximate costs per horse-power, the cost for a 15-in. cylinder assumed 100.

Diameter of cylinder, inches	Cost per horse-power
4	200
8	130
12	110
15	100
20	112
24	130
30	165
36	200

The most economical size is seen to be between 12 and 18 in. diam. A further limitation is the fact that cylinders exceeding 16 to 18 in. diam. should be water-cooled, which increases the cost per horse-power.

Thickness of cylinder-walls imposes another limitation at the upper end of the scale. A 36-in. cylinder requires walls 2¼ in. thick. Walls much thicker than this will not transmit the heat at the required rate.

For the above reasons, the limiting size of the four-cycle single-acting engine may be assumed at 500 brake horse-power per cylinder. For a six-cylinder engine this would give a maximum of 3000 hp. per shaft, or 6000 hp. per ship where twin screws are used. The author does not consider two-cycle engines on account of their high first cost.

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The Chinese Market for Machinery*

THE dominant factor in the Chinese machinery market at the present time is supply rather than demand. The War interfered with importation of all kinds of foreign goods, and as a result, local industries have expanded and new ones have been started. The result has been greatly increased demand for machinery, a demand that the shipping conditions already mentioned have made it almost impossible to satisfy.

Because of lack of capital, most Chinese enterprises are of a joint nature, the Chinese supplying the working capital and the foreigners supplying the fixed capital in the form of machinery and supplies. Frequently the original installation has been made at a loss, with a view to getting the profits from accessories, repairs, and renewals, and from other more profitable business obtained later. Usually, the Chinese wish to pay for a new installation from the profits. The control of the market exercised by the German machinery makers before the War was mainly based on their custom of taking part payment, with extensions for the balance over a term of years. Moreover, German firms carried a large amount of machinery in stock.

For the firm that is in a position to take a whole or part payment in an interest in the enterprise, the opportunities for the sale of machinery in China are practically unlimited. Conversely, the opportunities for doing business on the same terms as are customary in the United States are few. Fortunately, the extension of American banking facilities is beginning to make it possible for American manufacturers to supply equipment to enterprises in China without taking a share in these enterprises.

There are two general methods of securing machinery contracts. The first is to appoint one of the large mercantile houses having branches in all important cities as general agents for a term of years. In addition, it has been found advisable to send one or more qualified engineers, trained at the home factory, who use the offices and staff of the agent's branches on trips of inspection, and who co-operate with the agent's salesmen in obtaining business. The other method is to open branch offices in the principal trading centres and deal directly with the Chinese public. There are many variations of these two methods. On account of the peculiar conditions of Chinese trade, the first method is usually the best, particularly for firms just entering the field.

The total value of machinery imported into China during 1917 was approximately $10,000,000, of which about 50% came from Japan, 20% from Great Britain, 20% from the United States, and the remainder from various other countries. Both Japan and the United States have increased their exports of machinery to China during the past two or three years, the former more than the United States. When it is remembered that the total from all countries is less than $0.03 per inhabitant of China, it will be seen that the field is practically undeveloped.

Electrical materials and fittings led other kinds of machinery in 1917, the total value being $4,040,000. About 60% of this came from Japan and 20% from the United States.

Textile machinery is next in importance, $1,250,000 worth being imported in 1917. In spite of the difficulties in the way of British trade, Great Britain furnished over 50% of this amount. About 25% came from Japan, and 15% from Canada. The imports from the United States were negligible.

Sewing, embroidering, and knitting-machines valued at $450,000 were imported in 1917, of which the United States furnish a little more than 50% and Japan about 20%.

Boilers, turbines, and other propelling machinery valued at $340,000 were imported in 1917, the business being almost equally divided between Great Britain, Japan, and the United States in the order named.

Imports of machine-tools are increasing rapidly, amounting to $180,000 in 1917. Japan furnished 80% of this sum and the United States 18%.

American agricultural machinery was becoming popular in China in 1916, but the War made it necessary to curtail production, and Japan got nearly half the business in 1917. The total of imports was $110,000, of which the United States furnished about one-fourth. The opportunities for trade in this class of machinery are increasing.

About $3,600,000 of 'unclassified machinery' is listed as imported in 1917, of which Japan furnished about 45%, the United States 20%, and Great Britain 20%.

In general, while Japan now leads in most classes of machinery, there is a good opening for all kinds of American equipment.

*Abstract, special report of U. S. Bureau of Foreign and Domestic Commerce.

Effect of Phosphorus on Malleable Cast Iron

In a paper presented before the British Iron and Steel Institute, J. H. Teng describes a series of experiments on malleable castings containing different proportions of phosphorus. The following conclusions are given:

The addition of phosphorus does not cause any improvement in the mechanical properties of the casting, but on the contrary, it reduces the tenacity, elongation, and toughness. The bad effects of phosphorus, however, do not become marked until the proportion reaches about 0.2%, and this may be considered the approximate limit for commercial purposes. The success of the annealing operation is dependent more on the presence of a considerable amount of silicon and manganese than on the absence of sulphur.

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The Use of Pyrometers in the Metal Trades

By B. J. KLEIN*

Pyrometers as at present utilized by the metal trades are of comparatively recent origin. It is true that a survey of pyrometer development will carry one back as early as 1782, at which time the first practical device was used by Wedgewood, an English potter in operating

FIG. 1. PYROMETER WITH RECORDING CHART

his kilns. He made use of the contraction of clay at high temperatures. The Seger cones as employed in the ceramic industry represent another form that was developed at an early date and is still used. These cones curl over when certain temperatures are reached, but they are valueless thereafter, as they do not show how far beyond the critical point the temperature may pass, and they do not show the decrease of temperature.

Fusion-point pyrometers making use of the known melting-points of different metals have been used. There is also the specific-heat pyrometer, which depends upon the fact that if a body of metal of known weight is transferred from the furnace and plunged into a quantity of water of known weight and temperature, the increase of the temperature of the water will depend upon the temperature of the metal being tested. Optical pyrometers, radiation pyrometers, as well as electrical-resistance pyrometers (the latter being for lower temperatures) are now in common use for certain definite classes of work. The optical and radiation pyrometers are employed mainly for temperatures above 3000°F., which is the practical limit for platinum platinum-rhodium thermo-couples.

The thermo-electric pyrometer operating upon the principle discovered in 1820 by Seebeck, is at the present time the most widely used, and has been developed to a point where it may be considered a practical instrument for shop service. This principle involves the heating of the thermo-couple, consisting of two wires of dissimilar metals or alloys, so that one end is hotter than the other. This causes a current of electricity to flow, which can be measured by an electrical instrument, called a millivolt-meter, the scale being graduated in degrees of temperature. As a rule, for temperatures above 2000°F. these instruments are actuated by a thermo-couple, consisting of one element of platinum and the other of platinum containing 10% of rhodium. At 3000°F. this couple generates a potential of about 17 millivolts. However, owing to the fragility of this type of thermo-couple and its high first cost, the universal practice for temperatures below 2000°F. is to use base-metal couples made of inexpensive metals or alloys. These couples give acceptable service and are not fragile, being able to withstand the rough handling encountered in average shop use. They also provide over three times the power for actuating the millivolt-meter.

For some classes of service and for small furnaces all that is necessary to use is an indicating instrument as a guide to the operator in his work.

*The Bristol Co., San Francisco.

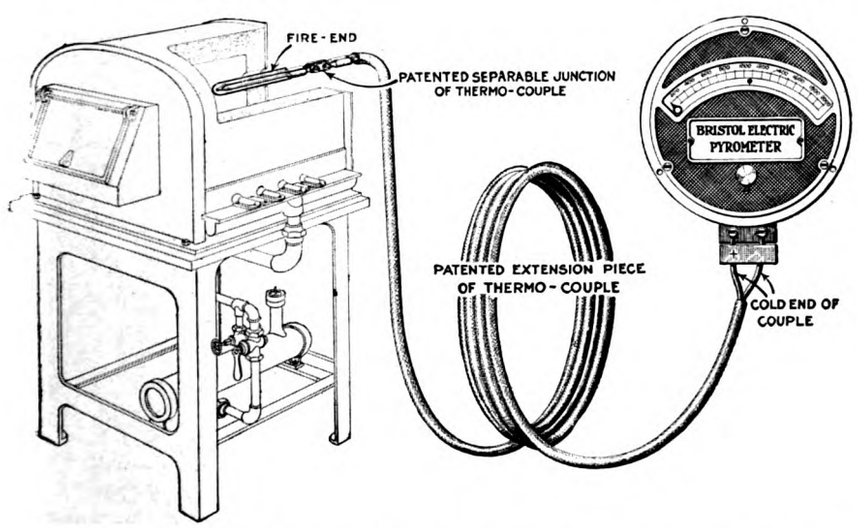

FIG. 2. METHOD OF APPLYING PYROMETER TO SMALL GAS-FURNACE

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For larger furnaces, however, and for service which requires long periods of heat treatment, it is necessary to use a recording instrument as shown by Fig. 1, in order that a proper check on the accuracy of the work may be established and that the necessity for close supervision during night operation in particular, may be avoided. Separate instruments can be connected to thermo-couples through switches so that any number of readings can be taken on a single instrument, eliminating the expense of separate installations.

Fig. 2 shows one method of applying a pyrometer to a small gas-furnace. Note that the work of installing is simple, and that the operator does not have to be an expert to secure good results, provided the details of the instrument design have been carefully considered by the manufacturer of the pyrometer together with the conditions under which it will have to operate.

It is advisable in all cases before purchasing pyrometer equipment for the prospective buyer to place before the manufacturer of the equipment, a complete outline of his furnaces, including the usual operating temperature, and to give some idea of the character of material being treated. The success secured with pyrometers is frequently almost entirely dependent upon the care with which these working conditions have been specified, as if the special conditions are not given consideration it will be impossible for the pyrometers to indicate or record temperatures accurately. On the other hand, with complete information at hand, pyrometer manufacturers can supply instruments that will convey accurately the exact temperature at all times, if they are thoroughly informed as to the service expected of the pyrometers. If suitable instruments are installed, the advantages derived are so great that the cost is absorbed soon after the equipment is in service and the outfit may be considered as an investment rather than an item of expense.

Iron Ore in the Celebes

Engineers for the Dutch government have made a study of the recently discovered deposits of iron ore in the Larona district in Celebes. The deposit is situated near the outlet of Towoeti lake about 20 miles from a point on the coast where shipments could be made, and at an elevation of 1000 ft. The area is about three square miles, and the estimates of the quantity of ore range from 160,000,000 to 214,000,000 tons. The ore extends to a depth of 40 to 45 ft. from the surface, and could be mined economically on a large scale with steam-shovels. The ore contains about 50% of iron, besides chrome, nickel, and manganese, resembling the Mayari ore of Cuba. As there is abundant water-power that can be developed, it is probable that the electric furnace will provide the best method for handling the ore, charcoal being used as a reducing agent.

Solders for Aluminum

Bulletin No. 78 of the U. S. Bureau of Standards discusses tests made of solders for aluminum and gives the following general conclusions:

1. All metals or combinations of metals used for aluminum soldering are electro-negative to aluminum. A soldered joint is therefore rapidly attacked when exposed to moisture and disintegrated. There is no solder for aluminum of which this is not true.

2. Joints should therefore never be made by soldering unless they are to be protected against corrosion by a paint or varnish, or unless they are quite heavy, such as repairs in castings, where corrosion and disintegration of the joint near the exposed surface would be of little consequence.

3. Solders are best applied without a flux, after preliminary cleaning and 'tinning' of the surfaces to be soldered. The composition of the solder may be varied within wide limits. It should consist of a tin base with addition of zinc or of both zinc and aluminum, the chief function of which is to produce a semi-fluid mixture within the range of soldering temperatures.

Suggested ranges of composition—Tin-zinc solders: zinc, 15 to 50% ; remainder tin. Tin-zinc-aluminum solders: zinc, 8 to 15% ; aluminum, 5 to 12% ; remainder tin.

4. The higher the temperature at which the 'tinning' is done, the better the adhesion of the tinned layer. By using the higher of the recommended zinc and aluminum percentages given above, the solder will be too stiff at low temperatures to solder readily and the workman will be obliged to use a higher temperature, thus securing a better joint. A perfect union between solder and aluminum is difficult to obtain.

5. The joint between previously tinned surfaces may be made by ordinary methods and with ordinary soft solder. Only the 'tinning' mixture need be special for aluminum.

6. There is no reason why a good solder for aluminum need be brittle as several commercial varieties are, and it is undesirable that it should be.

7. The tensile strength of a good aluminum solder is about 7000 lb. per square inch. The strength of a joint depends upon the type and upon the workmanship. Much dependence should not be placed on the strength of a joint.

A YOUNG school-teacher had punished Johnnie often for talking during schools and the punishment had been apparently without effect, so that, as a last resort, she decided to notify Johnnie's father of his son's fault. So following the deportment mark on his next report were these words: "Johnnie talks a great deal." In due time the report was returned with the father's signature, and under it was written, "You ought to hear his mother!"

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Manufacture of Crank-Shafts for Aeroplane Engines

By RICHARD VOSBRINK

A CONTRIBUTING factor to the difficulty of production of high class aeroplane engines is the necessity of using materials of the finest quality and workmanship. Limitation of weight, as well as other considerations, necessitate the use of special heat-treated alloy-steel to secure the necessary safety factors for the various parts of the engine. The crank-shaft in particular requires the utmost care in its manufacture in order to secure a satisfactory result.

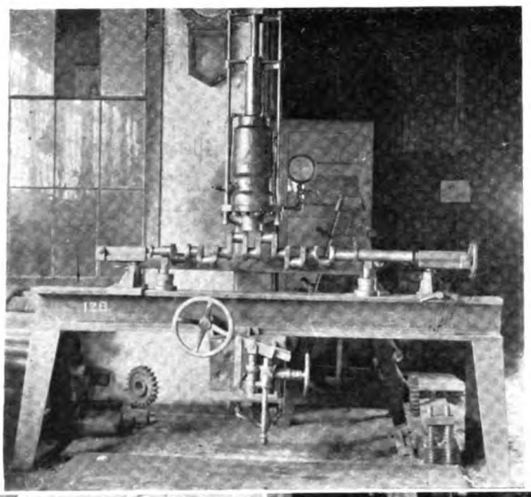
The enormous power developed by the standardized Government engine known as the Liberty motor, required careful engineering to determine the properties necessary to withstand the stresses generated when the engine is running at the maximum speed. Special heat-treated chrome-nickel steel is used for the forgings. The chemical composition is approximately as follows:

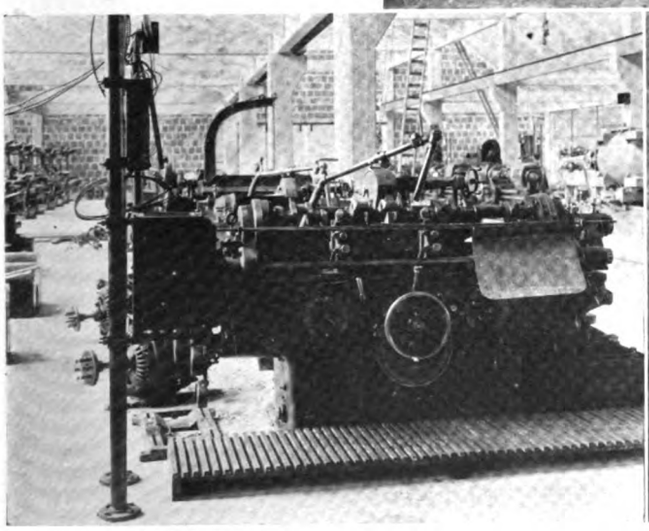
	%
Carbon	0.400 to 0.500
Manganese	0.630 to 0.710
Phosphorus	0.009 to 0.020
Sulphur	0.025 to 0.041
Nickel	1.600 to 1.900
Chrome	0.600 to 0.680

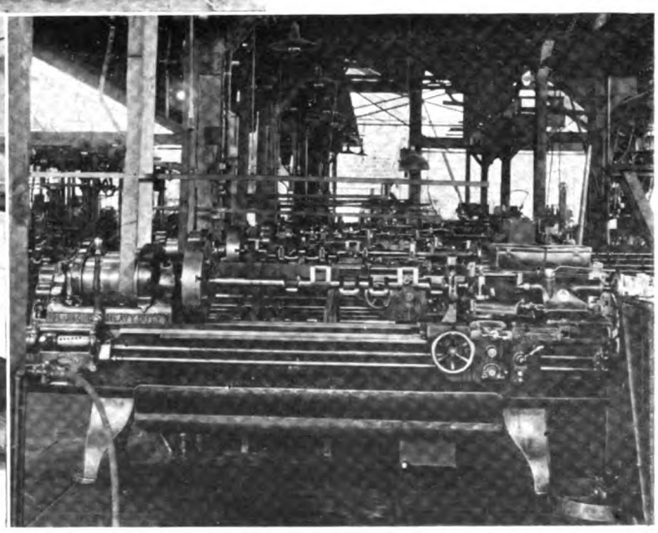
This alloy steel when properly heat-treated has approximately the following physical properties:

Elastic limit, pounds per square inch	130,000
Ultimate strength, pounds per square inch	150,000
Elongation, per cent	18
Reduction of area, per cent	55
Brinnell hardness	302
Izod impact-test	50

This material is difficult to work in the various machining processes as it is tough and hard. To secure the desired result it is necessary that each shaft be produced exactly to the Government specifications. The limits or tolerance of error are reduced to a minimum and the finished shaft is subjected to close inspection. Any slight deviation from the determined dimensions will cause the shaft to be rejected. The specifications require that the pins and journals must be to size within plus or minus 0.0005 in. Crank pins must be parallel with main bearings within 0.001 in. With shaft mounted on front and rear bearing, centre bearings must not run out to exceed 0.003 in., and







ON LEFT—LANDIS GRINDER USED FOR BOTH ROUGH AND FINISHED GRINDING. ABOVE—HYDRAULIC BENDING-PRESS FOR STRAIGHTENING SHAFTS AFTER ROUGH TURNING AND ROUGH GRINDING. BELOW—BATTERY OF LE BLOND LATHES. IN THE FOREGROUND IS A SHAFT WITH THE FLANGE END IN POSITION FOR FINISH TURNING, AND IMMEDIATELY BACK OF IT IS A SHAFT SET-UP FOR TURNING TAPER AND CUTTING THREADS.

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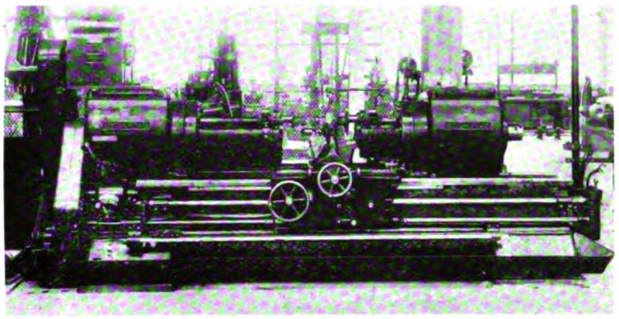
bearings must not vary from each other more than 0.001 in. With shaft mounted on front and rear bearings and one crank-pin, no crank-pin must be out of plane to exceed 0.01 in. Crank-pins and main bearings must not be out of round to exceed 0.00025 in., and taper, if any,



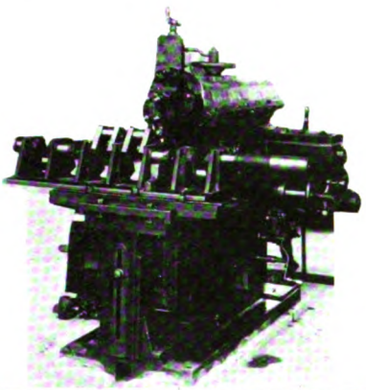
LODGE & SHIPLEY LATHE FOR TURNING CRANK-PINS. NOTE COUNTER-BALANCED HOLDING FIXTURES TO BALANCE THE REVOLVING ELEMENT WHILE TURNING.

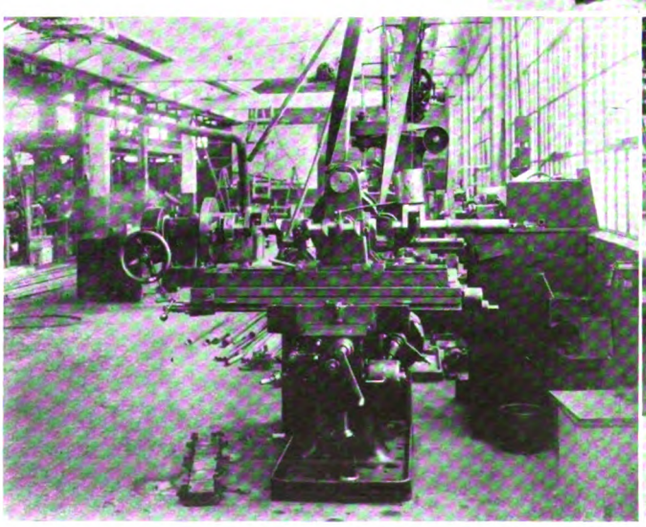
must be uniform. All contours must be accurately machined to drawing; chatter and tool marks will not be accepted.

Commercial crank-shafts as used in the average automobile are not stressed nearly as much as they are in an aeroplane engine. The factor of safety is higher, as weight and material are not so important. Steel manufacturers have developed their laboratory processes to a point where carbon-steel drop-forgings are satisfactory for automobile-engine crank-shafts. As most of these shafts are drop-forged nearly to size, manufacture in quantity is simple. A minimum of stock is allowed, and, in most instances, there are few operations for the machine-shop to perform. Centring, rough turning, grinding, and drilling usually complete the operations, consequently the unit cost is small, making it possible to sell these crank-shafts at a low price as compared to an aeroplane-engine shaft.

The Hall-Scott Motor Car Co. are producing Liberty crank-shafts in quantity for the U. S. Navy. The forgings are made by the Park Drop Forge Co. of Cleveland. There are about 32 distinct set-ups and machine operations on each crank before it is completed. These operations or processes can best be understood by referring to the illustrations. The machine processes follow closely the sequence as listed below:

1. Centre.
1a. Rough-turn ends.
2. Rough-turn journal and cheeks.
2a. Finish-turn journal and cheeks.
3. Straighten.
4. First rough-grind journals.
5. Turn pins No. 1 and 6.
6. Turn pins No. 2 and 5.
7. Turn pins No. 3 and 4.
8. Straighten.
9. First grind pins.
10. Drill pins.
11. Plane flats.
12. Plane bevels.
13. Grind radius.
14. Drill long end.
15. Drill journals.
16. Grind journal-cheeks.
17. Grind pin-cheeks.
18. Second rough-grind pins.
19. Counter-bore.
20. Drill web oil-holes.
21. Finish-grind pins.
22. Second rough-grind journals.
23. Finish-grind journals.
24. Finish turn taper.
25. Turn taper.
26. Thread.
27. Drill-pin and journal oil-holes.





AT LEFT—METHOD OF MILLING ROUNDED ENDS ON CRANK CHEEKS AND WEBS. ABOVE—SET-UP FOR PLANING BEVELS ON CRANK-WEBS. AT RIGHT—SET-UP FOR PLANING EDGES ON CHEEKS.

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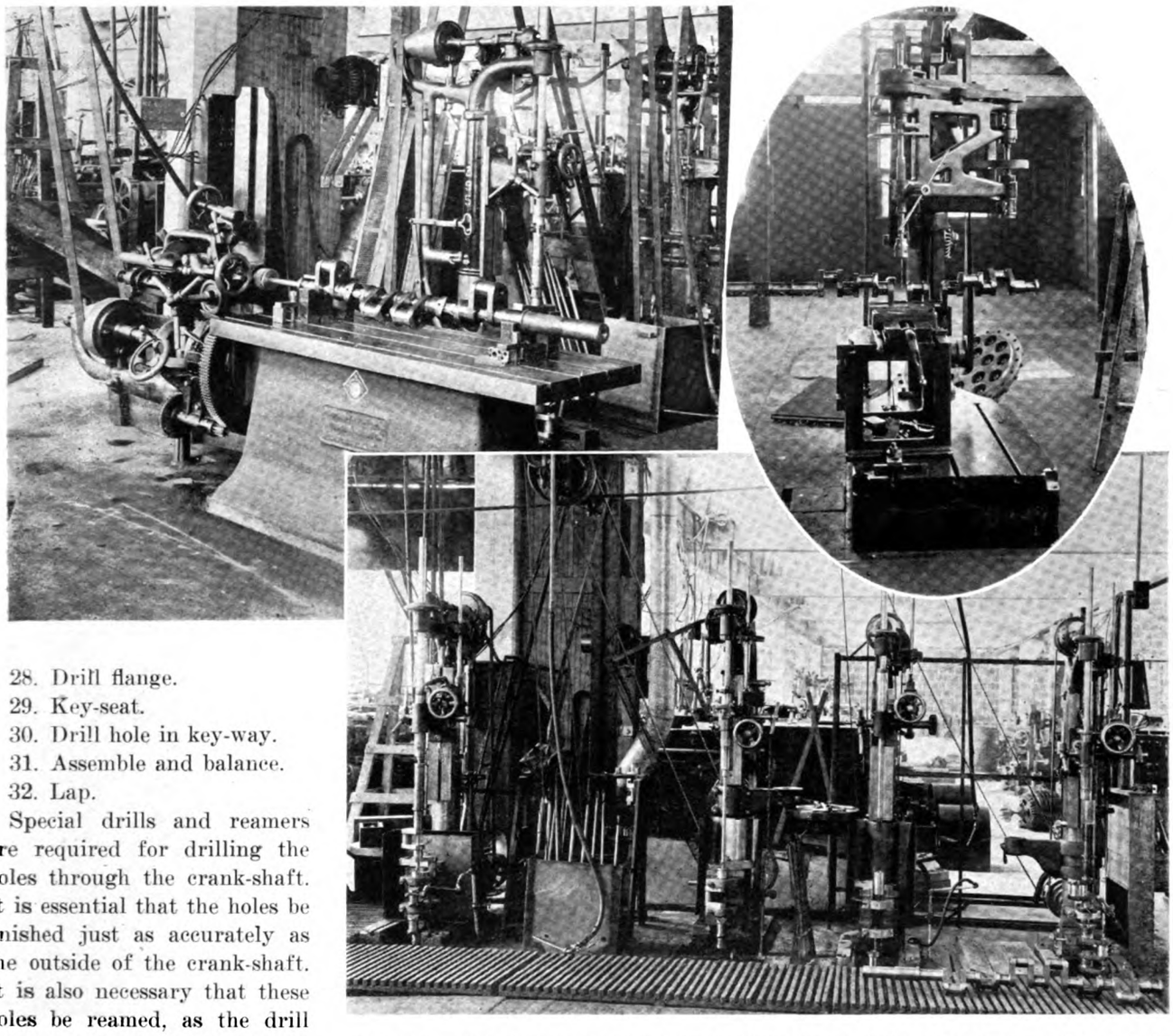

AT LEFT—CRANK-SHAFT SET-UP WITH BORING-BAR ARRANGED WITH CUTTERS FOR PRODUCING THE COUNTER-BORES IN THE CHEEKS OF THE CRANK. AT RIGHT—CRANK IN POSITION FOR DRILLING THE OIL-HOLES IN THE SHAFT. BELOW—BATTERY OF VERTICAL BORING-MILLS WITH CRANKS HELD IN SPECIAL FIXTURES AND EXTENDING INTO THE FLOOR-PITS.

28. Drill flange.
29. Key-seat.
30. Drill hole in key-way.
31. Assemble and balance.
32. Lap.

Special drills and reamers are required for drilling the holes through the crank-shaft. It is essential that the holes be finished just as accurately as the outside of the crank-shaft. It is also necessary that these holes be reamed, as the drill does not leave them smooth enough. Any rough or sharply defined corner or line on the crank-shaft produces a condition favorable to the development of a notch-stress, which considerably weakens the shaft. To understand this clearly the reader has but to refer to the familiar practice of a blacksmith in notching a piece of steel prior to breaking it. A similar condition would exist in a crank-shaft were sharp corners or unfilleted contours allowed. The crank-shafts are drilled to remove some excess metal and also to permit the circulation of lubricating oil through the main journal and connecting-rod bearings. The large hole drilled through the crank bearings and pins is counter-bored on either side of the cheeks and a plug is fitted into these counter-bores and secured in place with bolts. Small holes drilled radial to the centre and at right angles to the axis permit the oil to reach the necessary bearings.

If these shafts were produced in large quantities as a continuous product of the factory, a much more simple process of manufacture could no doubt be devised, but as the production is limited, it is necessary to use the available machine tool-equipment and design such necessary fixtures and jigs as will secure the most economical result with a comparatively limited production.

MISS SWEETGIRL was engaged to the curate, and she took it upon herself to look after him, as all nice women will.

He was going to officiate at a funeral, and she stood at the garden-gate, seeing him off.

"Take care of yourself, dear!" she said.

"Yes, yes—I will."

"Do," said the girl, still anxious. "And remember. Don't stand with your bare head on the damp ground."

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Statement Regarding Industrial Relations Prepared by United States Chamber of Commerce

A statement of principles of industrial relations, prepared with a view to furnishing a basis on which American industry can build a national labor program, has been submitted to a referendum vote of the membership of the Chamber of Commerce of the United States. The statement, which was prepared by a special committee after a long period of study of the entire subject of industrial relations, is as follows:

1. Industrial enterprise, as a source of livelihood for both employer and employee, should be so conducted that due consideration is given to the situation of all persons dependent upon it.

2. The public interest requires adjustment of industrial relations by peaceful methods.

3. Regularity and continuity of employment should be sought to the fullest extent possible and constitute a responsibility resting alike upon employers, wage-earners, and the public.

4. The right of workers to organize is as clearly recognized as that of any other element or part of the community.

5. Industrial harmony and prosperity will be most effectually promoted by adequate representation of the parties in interest. Existing forms of representation should be carefully studied and availed of in so far as they may be found to have merit and are adaptable to the peculiar conditions in the various industries.

6. Whenever agreements are made with respect to industrial relations they should be faithfully observed.

7. Such agreements should contain provision for prompt and final interpretation in the event of controversy regarding meaning or application.

8. Wages should be adjusted with due regard to the purchasing power of the wage and to the right of every man to an opportunity to earn a living at fair wages, to reasonable hours of work and working conditions, to a decent home, and to the enjoyment of proper social conditions.

9. Fixing of a basic day as a device for increasing compensation is a subterfuge that should be condemned.

10. Efficient production in conjunction with adequate wages is essential to successful industry. Arbitrary restriction on output below reasonable standards is harmful to the interests of wage earners, employers, and the public and should not be permitted. Industry, efficiency, and initiative, wherever found, should be encouraged and adequately rewarded, while indolence and indifference should be condemned.

11. Consideration of reduction in wages should not be reached until possibility of reduction of costs in all other directions has been exhausted.

12. Administration of employment and management of labor should be recognized as a distinct and important function of management and accorded its proper responsibility in administrative organization.

13. A system of national employment offices, with due provision for co-operation with existing State and municipal systems, can be made, under efficient management and if conducted with due regard to the equal interests of employers and employees in its proper administration, a most helpful agency, but only if all appointments are made strictly subject to the Civil Service law and rules. Policies governing the conduct of a national system of employment offices should be determined in conjunction with advisory boards—national, State, and local—equally representative of employers and employees.

Members of the committee signing the report are Harry P. Kendall, manufacturer, of Boston; Henry Bruere, vice-president, American Metal Co., formerly director, Bureau of Municipal Research, New York; Joseph H. Defrees, lawyer, of Chicago; William Butterworth, manufacturer, of Moline; John W. O'Leary, manufacturer, of Chicago; and Harry A. Wheeler, banker, of Chicago.

Opportunities for Trade With China*

Before the War, Germany and Japan were rapidly gaining on the United States and Great Britain in the control of Chinese trade, and, had not the War occurred, Germany would probably have dominated the market before many years had passed. At present, Germany is, of course, entirely out of the running, while Japan has made considerable advance, particularly in certain special lines. Nevertheless, there are many opportunities for the extension of the market for American goods.

One of the principal troubles with American, and also British, methods in the past has been that American and British merchants were interested in large orders only, while the Germans and the Japanese were not above the so-called 'muck and truck' trade. While the individual transactions may be relatively small, the aggregate of the 'muck and truck' trade is large enough to make it worth any merchant's time. Again, the Japanese quote c.i.f. prices at the Chinese dealer's door, and quote them in Chinese money and Chinese weights and measures. An American catalogue, on the other hand, is written in English, and quotes prices in American money and American units. Poor packing often interferes with the sale of American goods.

If, however, American manufacturers cater to the special requirements of the Chinese market, they should be able to build up a profitable trade. Two factors militate against Japanese trade expansion, namely, the strong anti-Japanese feeling in China, and second, the fact that Japanese manufactured articles are not of the best quality.

*Abstract from 'The Far Eastern Review'.

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Removal of Dust, Gases, and Fumes in Metal-Working Plants*

By J. J. ROSEDALE

ALTHOUGH the California State law (statutes of 1889 with amendments of 1909) requiring the installation of exhaust fans in factories where dust and injurious gases are produced had been in existence for some years before the Department of Safety of the Industrial Accident Commission was organized, I have frequently found dusty workshops without exhaust fans, where throat and lung diseases were prevalent among the workers.

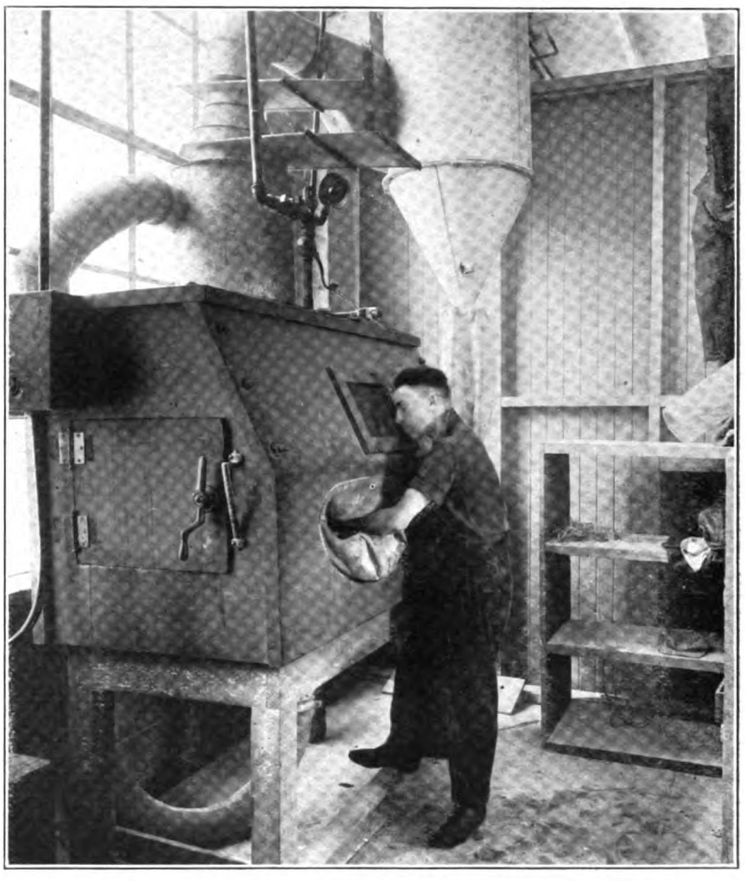
In some establishments it was found that the existing blower systems were inadequate and only 25 to 35% efficient. These hazardous places of employment are being rapidly corrected by the Department of Safety, since it is just as important to eliminate dust and injurious gases in workshops as to safeguard machinery.

Employers have been convinced that important as is the hygienic aspect there are other considerations which make adequate blower systems advantageous financially. The health of the workers is inseparably connected with their output and efficiency, and just as there is more work accomplished on a cool day than on a sweltering day, so a healthy workman breathing good pure air will do better work and more of it than a man who toils in an atmosphere that is laden with irritating offensive dust particles.

In wood-working plants, a clean shop constitutes an important factor in production. Machines littered with chips and shavings and floors covered with refuse delay operations and militate against an efficient day's work. Furthermore, dust injures machinery, particularly the bearings and working parts of fine machinery and electric motors. Gritty dust scores and scratches the surfaces, increases the wear, and makes much more lubricating oil necessary. I was recently informed in one plant where the Department of Safety was instrumental in installing an adequate blower system for removing gritty dust, that after being in operation a short period, the oil saving alone justified the expenditure, to say nothing of the other advantages.

The following specifications for the design, construction, and operation of exhaust systems are recommended for grinding and buffing wheels, with the view of bringing about more efficient removal of dust wherever such wheels are used:

1. Minimum sizes of branch pipes allowed for different-sized emery or other grinding wheels are given in the accompanying table. In case a wheel is thicker than given in the tabulation, or if a disc instead of a regular wheel is used, it must have a branch pipe no smaller than is required by its grinding surface.



SAND-BLAST AND DUST-REMOVING APPARATUS AT MARCHANT CALCULATING MACHINE COMPANY PLANT

*From 'California Safety News'. Acknowledgment is made to the Buffalo Forge Co., and to William Newell, of the Department of Labor of the State of New York, for data used in preparing this article.

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Table I—Grinding-Wheels

Diameter of wheels	Maximum grinding surface, square inches	Minimum diameter of branch pipe, inches
6 in. or less, not over 1 in. thick	19	3
7 to 9 in. inclusive, not over 1½ in. thick	43	3½
10 to 16 in. inclusive, not over 2 in. thick	101	4
17 to 19 in. inclusive, not over 3 in. thick	180	4½
20 to 24 in. inclusive, not over 4 in. thick	302	5
25 to 30 in. inclusive, not over 5 in. thick	472	6

GRINDING-STANDS CONNECTED TO EXHAUST SYSTEM AT ALUMINUM PRODUCTS COMPANY PLANT

Table II—Buffing-Wheels

Diameter of wheels	Maximum grinding surface, square inches	Minimum diameter of branch pipe, inches
6 in. or less, not over 1 in. thick	19	3½
7 to 12 in. inclusive, not over 1½ thick	57	4
13 to 16 in. inclusive, not over 2 in. thick	101	4½
17 to 20 in. inclusive, not over 3 in. thick	189	5
21 to 24 in. inclusive, not over 4 in. thick	302	5½
25 to 30 in. inclusive, not over 5 in. thick	472	6½

2. Minimum sizes of branch pipes allowed for different-sized buffing, polishing, or rag wheels, as they are variously called, are given in Table II.

Buffing wheels, 6 in. or less in diameter, used for jewelry work may have a 3-in. branch pipe.

The thickness given for buffing wheels applies to the thickness of the wheel at the centre. In case the wheel is thicker than given in the tabulation, it must have a branch pipe no smaller than is called for by its grinding surface.

3. Branch pipes must be not less than the sizes specified above throughout their entire length.

4. Branch pipes must enter the main suction-duct at an angle not exceeding 45°, and must incline in the direction of the air flow at junction with main.

5. Branch pipes must not project into the main duct.

6. All laps in piping must be made in the direction of the air flow.

7. All bends, turns or elbows, whether in the main or branch pipes, must be made with a radius in the throat at least equal to one and one-half times the diameter of the pipe to which they are connected.

8. The inlet of the fan or exhauster shall be at least 20% greater in area than the sum of the areas of all the branch pipes, and such increase shall be carried proportionately throughout the entire length of the main suction duct, that is, the area of the main at any point shall be at least 20% greater than the combined areas of the branch pipes entering it between such point and the tail-end or dead-end of the system.

Table III—Proportions of Main Duct to Accommodate Branches

Number of branch pipes.	Diameter of branch pipes, inches: 3	3½	4	4½	5	5½	6	6½	7
	Area of each branch pipe, square inches: 7.07	9.62	12.566	15.9	19.635	23.758	28.274	33.183	38.485
	Area of each branch pipe plus 20%, square inches: 8.481	11.544	15.08	19.08	23.562	28.51	33.93	39.82	46.182
1	3⅝	3⅞	4⅜	5	5½	6	6⅝	7⅛	7¾
2	4¾	5½	6¼	7	7¾	8⅝	9¼	10⅛	10⅞
3	5¾	6⅝	7⅝	8⅝	9½	10½	11½	12⅜	13¼
4	6⅝	7¾	8¾	9⅞	11	12⅛	13⅛	14¼	15⅜
5	7⅜	8⅝	9⅞	11	12¼	13½	14¾	16	17⅛
6	8⅛	9½	10¾	12⅛	13½	14¾	16⅛	17½	18¾
7	8¾	10¼	11⅝	13⅛	14½	16	17½	18¾	20¼
8	9⅜	10⅞	12⅜	14	15½	17⅛	18⅝	20⅛	21¾
9	9⅞	11½	13⅛	14⅞	16½	18⅛	19¾	21⅜	23
10	10½	12⅛	13⅞	15⅝	17⅜	19⅛	20¾	22½	24¼
11	11	12¾	14⅝	16⅜	18¼	20	21⅞	23⅝	25½
12	11½	13⅜	15¼	17⅛	19	20⅞	22¾	24¾	26⅝
13	11⅞	13⅞	15⅞	17⅞	19¾	21¾	23¾	25¾	27¾
14	12⅜	14⅜	16½	18½	20½	22⅝	24⅝	26¾	28¾
15	12¾	14⅞	17	19⅛	21¼	23⅜	25½	27⅝	29¾
16	13¼	15⅜	17⅝	19¾	22	24⅛	26⅜	28½	30¾
17	13⅝	15⅞	18⅛	20⅜	22⅝	24⅞	27⅛	29⅜	31⅝
18	14	16⅜	18⅝	21	23¼	25⅝	27⅞	30¼	32⅝
19	14⅜	16¾	19⅛	21½	23⅞	26¼	28¾	31⅛	33½
20	14¾	17⅛	19⅝	22⅛	24½	27	29½	31⅞	34⅜
21	15⅛	17⅝	20⅛	22⅝	25⅛	27⅝	30⅛	32¾	35⅛
22	15½	18	20⅝	23⅛	25¾	28⅜	30⅞	33½	36
23	15¾	18½	21⅛	23¾	26⅜	29	31½	34¼	36¾
24	16⅛	18⅞	21½	24¼	26⅞	29⅝	32¼	34⅞	37⅝
25	16½	19¼	22	24¾	27½	30⅛	32⅞	35⅝	38⅜
26	16¾	19⅝	22⅜	25⅛	28	30¾	33½	36⅜	39⅛
27	17⅛	20	22⅞	25⅝	28½	31⅜	34⅛	37	39⅞
28	17½	20⅜	23¼	26⅛	29	32	34¾	37¾	40⅝
29	17¾	20⅞	23⅝	26⅝	29½	32½	35½	38⅝	41⅜
30	18	21	24	27	30	33	36	39	42

For the convenience of the designer, Table III is given showing what the size of the main suction-duct should be at any point for any number of uniform-size branch pipes when the main duct is made 20% greater that the combined areas of the branches entering it—the minimum required by these specifications.

9. The area of the discharge-pipe from the fan shall be as large or larger than the area of the fan-inlet, throughout its entire length.

10. The main trunk-lines, both suction and discharge, shall be provided with suitable clean-out doors not over ten feet apart, and the end of the main suction-duct shall be blanked off with a removable cap placed on the end.

11. Sufficient static suction-

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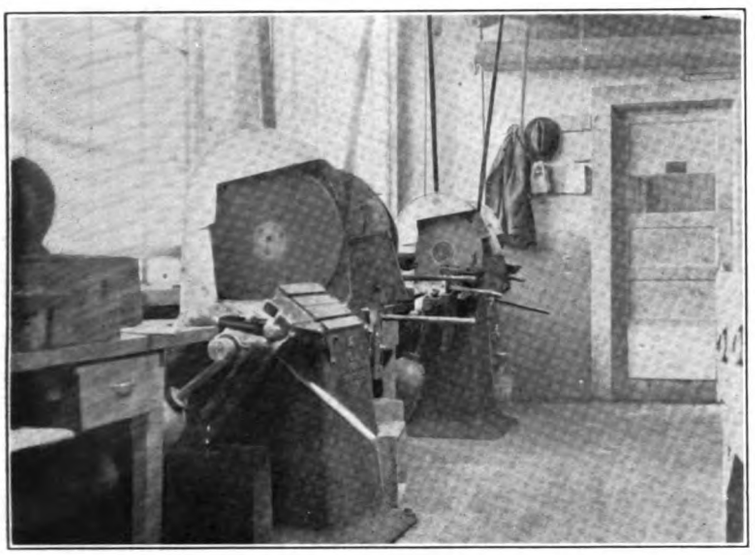
head shall be maintained in each branch pipe within one foot of the hood to produce a difference in level of two inches of water between two sides of a U-shaped tube. Test is to made by placing one end of a rubber tube over the small hole made in the pipe, the other end of the tube being connected to one side of a U-shaped water-gauge.

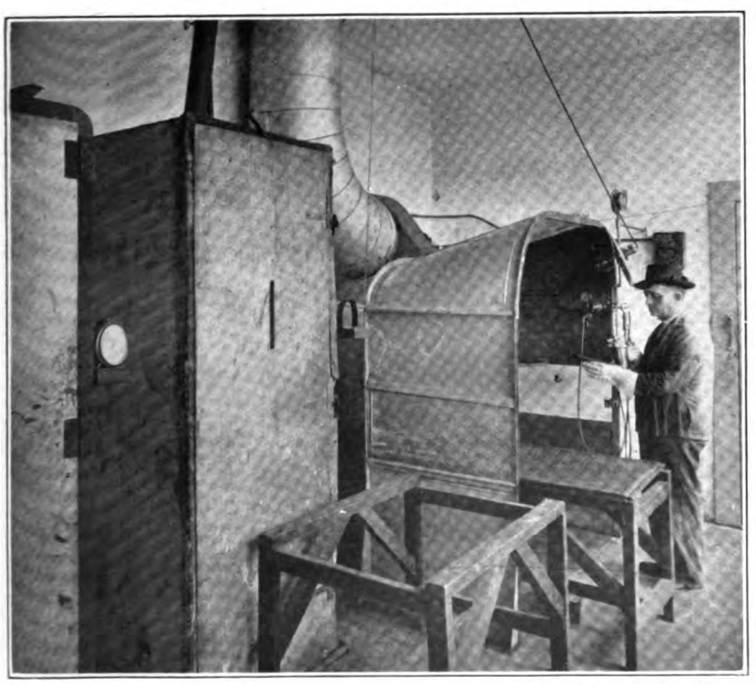


DISK-GRINDER WITH EXHAUST ARRANGEMENT AT MARCHANT PLANT

Test is to be made with all branch pipes open and unobstructed.

RECOMMENDATIONS

1. Emery-wheel and buffing-wheel exhaust systems should be kept separate owing to danger of sparks from the former setting fire to the lint dust from the latter, if both are drawn into the same suction-main.



EXHAUST SYSTEM FOR REMOVING FUMES IN ENAMEL-SPRAYING AT MARCHANG PLANT

2. In the case of undershot wheels, that is, where the top of the wheel runs toward the operator, the main suction-duct should be back of and below the wheels and as close to them as is practicable, or it should be fastened to the ceiling or the floor below, preferably the former. If behind the wheels, it should be not less than six inches above the floor at every point to avoid possible charring of the floor in case of fire in the main duct and also to permit sweeping under it. For similar reasons it should be at least six inches below any ceiling under which it may run.

3. Both the main suction and discharge pipes should be made as short and with as few bends as possible, to avoid loss by friction. If one or the other must be of considerable length, it is best to place the fan not far beyond where the nearest branch enters the large end of the main, as a long discharge-main is a lesser evil than a long suction-main.

4. Avoid any pockets or low places in ducts where dust might accumulate.

5. The main suction-duct should be enlarged between every branch pipe entering it, wherever space permits, and in no case should the main duct receive more than two branches in a section of uniform area. All enlargements in the size of the main should be made on a taper and not by an abrupt change.

6. If there is a likelihood of a few additional wheels being installed in the future, it is advisable to leave a space for them between the fan and the first branch and to put in an extra size fan. Or, a space may be left beyond the fan so that the fan may be moved and the main extended when it is actually decided to install additional wheels, provided the fan is of sufficient size to comply with these specifications after the addition branches are added.

7. Branch pipes should enter the main on top or sides, never at the bottom. Two branches should not enter a main directly opposite one another.

8. Each branch pipe should be equipped with a shut-off damper, or blast-gate as it is also called, which may be closed, if desirable, when the wheel is not in use. Not more than 25% of such blast-gates should be closed at one time; otherwise, the air velocity in the main duct may drop too low and let the dust accumulate on the bottom.

9. It is important that the lower part of the hood shall come far enough forward beneath the front wheel so that the dust will enter the hood and not fall outside of it altogether, even if the accomplishment of this result necessitates leaving considerable space between the wheel and the lower part of the hood in order that the hood shall not interfere with the work.

10. Branch pipes should lead out of the

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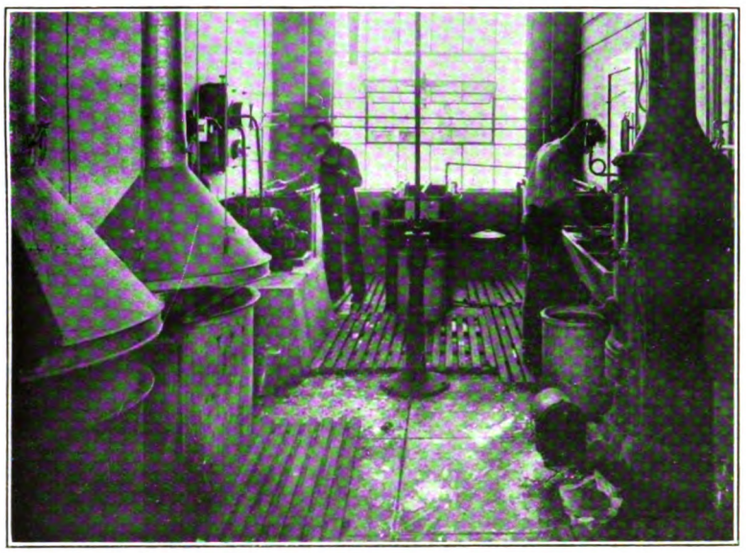
hood as nearly as possible at the point where the dust will naturally be thrown into them by the wheels.

11. An objectionable practice sometimes found where small work is polished is the use of a screen across the mouth of the branch pipe where it enters the hood. Such screens are an obstruction to the passage of material, and



EXHAUST SYSTEM IN NICKEL-PLATING ROOM AT MARCHANT PLANT

the ravelings from buffing wheels are held against the screen by the suction, with the result that in a short time the draft is almost entirely cut off.

12. The use of a trap at the junction of the hood and branch pipe is good practice, provided it is cleaned out regularly and not allowed to fill up with dust. This will

BUFFING AND POLISHING ROOM AT ALUMINUM PRODUCTS PLANT

catch the heavier particles and so take some wear off the fan. It will also serve to catch any nuts, pieces of tripoli, etc., dropped by accident, and with work on small articles, will enable them to be recovered when dropped in the hood.

13. Wherever space permits, all bends, turns, or elbows, whether in the main or branch pipes, should be made wiith a radius in the throat of twice the diameter of the pipe on which they are connected.

14. Elbows should be made of metal, one or two gauges heavier than the pipe to which they are connected, as the wear on them is much greater.

15. This withdrawal of air from the room by an exhaust system naturally tends to create a slight vacuum and for this reason inlets for air at least equal to the sum of the areas of the branch pipes should be left open.

16. Recommendations for the size of the cyclone-separator or dust collector, as it is often called, are hard to give, as the separator must be proportioned to suit operating conditions, light dusts requiring a larger separator than heavier dusts. A separator should be selected with an inlet area at least as large as the area of the discharge pipe from the fan. For light buffing dusts, lint, and similar substances, the air outlet from the top of the separator should be so large that the velocity of discharge will not exceed 300 to 480 ft. per minute; then select a separator of which the other dimensions are proportionate. The air outlet should be provided with a canopy or elbow to exclude the weather, but should otherwise be unobstructed.

Large Electrical Steel Plant

The plant of the British Forgings Co., Ltd., at Toronto, Canada, which was constructed during the War for munition work has the largest capacity of any electric-steel plant in the world. There are 10 Heroult furnaces, with a capacity of 6 tons each. Current is supplied at 13,000 volts, 3-phase, 25-cycle. During the War, most of the material used was steel-scrap turnings and borings from the various shell-plants in Canada.

The plant also has a forge-shop equipped with six 500-ton presses. A feature of the forge department is a heat-treatment building equipped with a large car-bottom oil-fired furnace, with two cars, permitting the filling of one car while the other is being treated. Each car holds 200 shell-forgings standing on end. At each end of the furnace is suspended an iron-plate cover, with louvre shutters, which can be lowered to cover the entire car when it is necessary to cool the forgings slowly. Near the furnace are two 5-unit air-cooling machines, each equipped with two blowers with a capacity of 500 cu. ft. of air per minute at a 12-oz. pressure. The forgings are treated in this machine when it is necessary to cool them rapidly, and some remarkable results in tempering and hardening are obtained.

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The Use of Manganese Alloys in Open-Hearth Steel Practice*

By SAMUEL L. HOYT

THIS investigation was planned to determine (1) the conditions in open-hearth practice that would lead to a conservation of manganese, both during the working of the heat and in making final additions; (2) the most satisfactory metallurgical conditions for the use of manganese in the form of low-grade or special alloys; and (3) the effect on the finished steel, both as to quality and 'condition', of the various methods and processes studied.

Without attempting to enter upon a discussion of the physical chemistry of a heat of molten steel, it may be said that the quality of a heat of steel must depend, aside from the temperature, upon the composition of the steel in those substances that affect the 'condition'. Of these there are two kinds: (1) Those that promote 'openness', or the gases, which again may be classified as (a) gases that are products of chemical reactions, and (b) gases that are absorbed from the furnace-gases, and (2) those that promote 'soundness', such as the reducing and solidifying agents, carbon, manganese, silicon, and aluminum.

The use of manganese is not merely an expedient, one for which some substitute might readily be used, but rather, one of the essential requirements of successful practice in working steel. It is, however, true that the actual amount of manganese used in a heat of steel is often greater than purely metallurgical considerations demand and any excess could well be considered as so much wasted. The first function of manganese, broadly considered, is to refine and 'settle up' the molten bath of steel. The aim is to put the metal in a proper condition for pouring, and to produce ingots (or castings) of the desired quality and texture. While manganese is not the most efficient of the elements that can be used for this purpose, calculated from the heat of combustion of the element to its oxide, it is without doubt the most satisfactory element on account of the excellent condition (freedom from objectionable foreign inclusions) in which it leaves the bath. To ensure efficient 'de-oxidation', a well-made heat of steel would probably not require more than 0.35% manganese.

The first function of manganese is to refine and 'settle up' the molten bath of steel.

Manganese is also desirable in steel to improve the rolling properties, in which capacity it appears to serve a dual purpose. First of all, manganese de-oxidizes and refines the molten steel in such a way as to give ingots of the desired texture without robbing the steel of its hot-working properties. Thus, ingots may be rolled into finished shape without the formation, in excessive amount, of fissures or of surface defects. Other reducing agents, such as aluminum and silicon, are likely to leave the metal in a poor condition for rolling and forging. While they eliminate one cause of hot shortness, iron oxide, they fail to convert the sulphur into a harmless form, as manganese does, and leave behind their highly refractory oxides, both of which tend to produce poor rolling qualities. Secondly, manganese, by retarding the rate of coalescence or grain growth, renders steel less sensitive to the effects of the high temperatures used in rolling and is supposed to promote plasticity, at least in ordinary steels, at rolling temperatures. Silicon and aluminum, on the other hand, increase, rather than decrease, the grain-size of steel. The proportion of manganese required in this capacity probably does not exceed 0.35% in well-made steel.

Manganese is also desirable in steel to improve the rolling properties.

The foregoing discussion indicates that manganese is an important factor in the steel industry. Of course, material such as 'American ingot iron' can be rolled successfully, even though no manganese be added, but this requires greater time and care. It is interesting to note that manganese, coming in the periodic system between iron and the strengthening elements on one side and the hardening elements on the other, has the dual function of strengthening and of hardening steel, which is not possessed by any other element.

Manganese conservation can best be obtained by eliminating the manganese specification except when the amount present in the finished steel has some definite bearing on the properties or heat treatment of the steel. In other words, whenever casting and rolling-mill practice (plant problems) only are involved, the steel maker should be allowed to exercise his own judgment as to the amount of manganese which should be used to give the most satisfactory

Whenever casting and rolling-mill practice only are involved, the steel maker should be allowed to exercise his own judgment as to the amount of manganese to be used.

*Abstract from bulletin No. 11 of the War Minerals Investigation Series, issued by the U. S. Bureau of Mines.

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and economical practice, and the finish and quality of the product should be controlled by adequate inspection. On the basis of Ellicott's figures,† reducing the manganese requirements by 0.2% in making plates, shapes, and other low-carbon steel (estimated production, 21,350,000 tons,) would save 54,000 tons of 80% ferro-manganese.

The investigation here reported indicated that three practices for utilizing our domestic alloys in open-hearth steel practice seem to commend themselves above the others. These are as follows (but not in the order of their importance):

1. The use of a 'molten-spiegel mixture' for de-oxidation and re-carburization.

2. The practice of melting and refining the steel bath so as to insure a comparatively high residual manganese content, say 0.3% manganese.

3. The use of manganese alloys containing silicon.

At a few plants re-carburization and de-oxidation are combined in one operation by using a mixture of pig-iron and spiegel that has been pre-melted in a cupola. This 'molten-spiegel mixture' contains 5 to 11% manganese, 4% carbon, and the desired amount of silicon, and is added to the ladle during the tapping-time in such a way as to cause a thorough and uniform mixture of the two streams. The principal advantages of interest here, not considering questions of plant and operating economy, are as follows:

A mixture of pre-melted pig-iron and spiegel is used to advantage at some plants.

1. A low-grade or domestic alloy can be used in the preparation of the 'mixture'.

2. The de-oxidation is accomplished by means of a dilute solution with a consequent increase (on theoretical grounds) of the efficiency of the de-oxidizer.

3. The de-oxidizer is added in the molten state, insuring certain attendant advantages.

4. A special advantage, if a large steel output is desired, is that the amount of the re-carburizer is comparatively large and the capacity of the plant is materially (and economically) increased thereby. There is some question as to the propriety of including this advantage as peculiar to this particular practice. The use of pig-iron as a re-carburizer may be accomplished in other ways with the same economy and increase in plant capacity.

5. As compared with the results in the usual practice of adding carbon and manganese, there should be less likelihood of missing a heat.

This practice, at least at the plant visited, and it is understood to be the same elsewhere, is limited to the manufacture of the high-carbon steels or those running 0.30% or more of carbon. To make steels with 0.20% carbon would require the working of the carbon until the content was about 0.10%, and the molten mixture added would have to contain about 20% manganese (spiegel). The amount of the addition would be reduced from 13,000 lb. to about 4000 lb., which would mean that some of the advantages just enumerated would be lessened, and, with the increased loss of manganese the practice would probably not be commercially feasible. However, when the other alternative—the use of ferro-manganese, either solid or liquid—is considered, the practice of pre-melting spiegel in the cupola has its advantages. In case of undue shortage of high-grade ferro-manganese there can be no doubt that the practice would offer a ready solution of the problem of using domestic alloys in making steel for shapes, plates, and similar uses. Against the increased cost of production, as compared with the cost of cold ferro-manganese practice, there would be the greater uniformity of product and more uniform practice as an offset.

At certain plants the practice of preferential oxidation and elimination of carbon and phosphorus has been developed, the residual manganese being kept at a comparatively high value, say, 0.25 to 0.30% as compared with 0.10% manganese for a final carbon content of 0.10%. This is accomplished, broadly speaking, (1) by rapidly removing the phosphorus and retaining it as stable calcium phosphate during the earlier and colder period of melting; (2) by maintaining a high finishing temperature and working the charge with a high manganese content so that the slag contains about 8% manganese; and (3) by increasing the lime content of the slag to about 47% as a minimum. The practice, correctly applied, leads to the production of high-grade and uniform steel, which in itself means increased rolling-mill output, fewer rejections, and a more ready market. This is largely due to the fact that the steel is made, where it should be made, in the furnace.

The steel is made, where it should be made, in the furnace.

A second advantage, caused by the high manganese oxide and calcium oxide contents of the slag, is that the manganese finals can be added to the furnace with a recovery comparing favorably with that of ladle additions. A third advantage is that the pig-iron used for the charge, which contains appreciably more manganese than ordinary basic iron does, can be used to re-carburize and partly de-oxidize the bath. The remainder of the manganese is added as ferro-manganese. At a steel plant that operates in conjunction with a blast-furnace plant, a harmonious and economical cycle of plant operations is made possible. At the same time the open-hearth slag can be re-smelted in the blast-furnace for the recovery of the iron and manganese and the utilization of the lime.

This procedure is largely dependent upon the amount of phosphorus in the slag, for, obviously, it would not be worth while to recover the manganese at the expense of unduly increasing the phosphorus content of the pig-iron. In this country we are fortunately situated in this respect, inasmuch as there is still a large amount of rather low phosphorus ore available. No definite figure can be given at this time as to the maximum allowable phosphorus content of the pig-iron, but it is the opinion of at least one steel maker who uses this process that 0.6% phosphorus would not be prohibitive. Under the condi-

†Ellicott, C. R., 'Manganese Conservation in Steel Making', 'Iron Age', Vol. 101 June 6, 1918, p. 1484-1485.

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tions prevailing during the past year, this practice possessed the additional advantages that the high-manganese pig-iron could be procured by smelting domestic manganiferous iron ore and that the manganese alloy added to the furnace at the end of the heat could as well be spiegel as ferro-manganese, assuming that the finished steel contains more than about 0.10% carbon. There are also certain advantages, in particular, the carbon content of the bath has to be worked to a lower figure than in present practice. On account of the high cost of spiegel and the greater time required, it is doubtful whether the steel plants would substitute spiegel for ferro-manganese. Another interesting point, in connection with the possibility of utilizing domestic manganiferous iron ore, is that low-silica ore could be added to the slag as a source of manganese oxide.

The high manganese content of the charge is generally obtained by using a 'high-manganese' pig-iron (2 to 3% manganese), but may also be obtained by adding manganese ore to the slag, or manganese alloys to the bath, or by a combination of these methods. This point would be determined by plant economy but it seems doubtful whether the practice would be worth while unless a high-manganese pig-iron were available. The writer is informed by one blast-furnace superintendent that running the manganese up to 2% does not materially affect the production, so that lowering of pig-iron production would not be held as a disadvantage in this practice. The loss of manganese by oxidation and transference to the slag is considerable. This loss may be kept at a minimum by increasing the basicity of the slag in calcium oxide and iron oxide, which, combined with the manganese oxide, which also acts as a base, exert the desired effect upon the manganese of the bath.

As the working of the charge progresses, its temperature rises until finally with the high calcium oxide, and, particularly the high manganese oxide content of the slag, the carbon is eliminated more rapidly than the manganese, with the result already stated, namely, the manganese can be held to about 0.3% at the end of the heat. Present data indicate, unfortunately, that no material decrease in the amount of manganese required and no material increase in the recovery of manganese in the additions may be expected, so that the advantages are derived not from a decreased consumption but from the form in which it can be added.

The high silica content of most of our domestic manganese and manganiferous-iron ores made it advisable to consider the possible use of manganese-silicon alloys in steel making, in both acid and basic practice. For the purposes of the present discussion, these alloys will be divided roughly into two classes—high-grade silico-manganese containing 50% manganese and 25% silicon, and low-grade silico-spiegel with 15 to 20% silicon, 30 to 35% manganese, and 50% iron. The manganese-silicon ratio of the first alloy is 2 and of the second alloy $2\frac{1}{3}$ to $1\frac{1}{2}$. Either of these alloys can be made from the silicious manganese ores of California and Montana, and the low-grade alloys can be made from the silicious manganiferous iron ores of Minnesota.

Manganese-silicon alloys may be used in both acid and basic practice.

Silicon is an efficient reducing or settling agent when used in the customary small amounts. Silico-manganese has been used extensively in Europe. In this country it was used at certain plants as standard practice until the supply was cut off by the War. Silicon is an efficient reducing or settling agent when used in the customary small amounts, but it may or may not be desirable in the finished steel. On this account, the possibility of using manganese-silicon alloys depends upon the amount of silicon that can be tolerated in the finished steel in the ingot form. In certain grades of steel, particularly in steel that must be welded, silicon should be low or practically absent. In steel for sheets and plates, which must give a good finished surface, the most efficient rolling-mill practice requires that the silicon be kept tolerably low, but it is believed that 0.10 to 0.15% could be used, provided the manganese content were not too high. In forging steel, high-carbon steels, and castings, where the aim is to produce sound steel, more silicon can be used, or between 0.20 and 0.35%. Of these three fields, the latter is the one in which manganese-silicon alloys will find their first application. In the second field, it seems probable that conditions will many times permit their use; but from the nature of things manganese-silicon alloys cannot be used to make steels of the first group, those that must be welded.

It is with considerable hesitation that the discussion of manganese-silicon alloys in open-hearth practice is approached, particularly as the controversial character of many of the points is so clearly recognized. Consequently, I will state briefly the manner in which I first became interested in the possibilities of their use. A number of years ago I conducted a series of experiments on the occurrence and identification of foreign inclusions in acid open-hearth steel, principally ordnance-steel. In this work ferro-manganese, ferro-silicon, and a mixture of ferro-manganese and ferro-silicon were added to a steel sample taken shortly after 'oreing', that is, to 'wild' steel, in an attempt to produce an excess of the constituent, or constituents, supposed to form as a result of the addition.

It seemed fairly clear as a result of this work that the use of silicon was apt to be dangerous, not on account of any harmful effect of the residual metallic silicon but because it produced a highly refractory silicate that was likely to remain in the ingot and produce hot-shortness. Hence the idea was suggested that a manganese-silicon alloy might, and probably would, form a manganese silicate containing some ferrous oxide (a true slag) which would be fluid and more readily coalesce into larger particles than the refractory silicate, and would therefore free itself more readily from the steel. By using such an alloy it would then be possible to take full advantage of the use of silicon as a de-oxidizer without suffering the usual attendant disadvantages of its use. None of the manganese-silicon alloy was available at the

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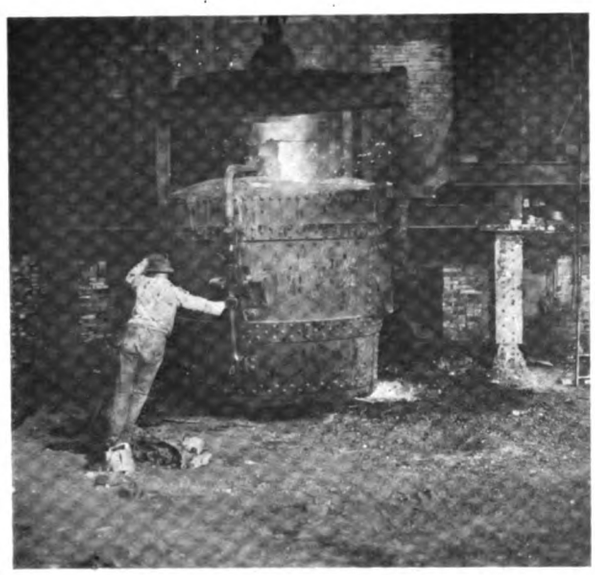
time so a parallel experiment could not be conducted.

Another point of great technical importance is the percentage recovery of manganese when added as silico-manganese and as ferro-manganese along with ferro-silicon. First of all let it be stated that a 100% recovery, based on the present theory of 'de-oxidation', is hardly possible, and if possible would not be desirable. Such recovery would mean a retention of the products of the de-oxidation. A method of addition that would lead to a satisfactory de-oxidation and yet would eliminate the loss due to admixture with the slag, volatilization, etc., and could be accomplished with the minimum amount of manganese, would be desirable because it would lead to both conservation of manganese and uniformity of composition of the steel.



FILLING LADLE FROM OPEN-HEARTH FURNACE

Records are available of heats made with silico-manganese covering a period of several years, from which some fairly satisfactory conclusions may be drawn bearing on these points. During this time when silico-manganese was being used there were periods when the alloy was not available and the mixture of ferro-manganese and ferro-silicon had to be substituted. Thus, a direct comparison of these two methods of de-oxidation was afforded. Certain results taken from the heat records, and believed to be typical, are given in the table following.

This table shows that the same results (manganese and silicon contents of the finished steel), by using silico-manganese can be obtained with consistently smaller amounts of both manganese and silicon, as compared with the combination of ferro-manganese and ferro-silicon. In addition there is the advantage of having a more uniform practice, which in itself would warrant smaller additions. The weights of the additions favor the silico-manganese; thus in heats *A*, *C*, and *D*, 460 lb. was added, as compared with 385 lb. for heat *G*, and in heats *B* and *E*, 615 lb. was added, as compared with 510 lb. in heats *F*, *H*, and *I*. The low carbon content of the silico-manganese may or may not be a material advantage, but at any rate it is in favor of the single-alloy addition because the carbon need not be worked as low and there seems to be less danger of missing the carbon.

No information is available bearing on the use of manganese-silicon alloys in electric-furnace practice, but we may at least consider such practice on the basis of the known behavior of such alloys. Considering acid-casting practice first, there seems to be no reasonable doubt that either silico-manganese or silico-spiegel could be at once substituted for ferro-manganese and ferro-silicon. Inasmuch as the usual aim is to make high-grade castings, the manganese-silicon alloys would appear to have the distinct advantage of making sounder and cleaner steel. Silico-spiegel, aside from possessing the theoretical advantage of being diluted with iron, could be more readily prepared with the correct manganese-silicon ratio so as to eliminate the use of an additional alloy. In this practice the advantage of greater dilution need not carry with it the disadvantage of increased weight on account of the higher temperature of the electric furnace. The uncertainty of our knowledge as to the relative behavior of the manganese-silicon alloys as compared with that of the ferro-alloys, and the relative efficiencies of low-grade and high-grade alloys, as well as the importance of this step in the manufacture of steel, suggest the advisability of conducting a definite research to settle such points. It would seem that there is no better place for such a research than in this particular industry. In basic electric-furnace practice the manganese-silicon alloys, on the same grounds, could likewise be utilized, particularly as the attempt is always to produce sound and clean ingots. However, in this practice, ferro-silicon is used as a reducing agent along with coke, and hence the operator would probably not see any advantage in changing his practice.

Manganese-silicon alloys should be satisfactory in the electric furnace.

Comparative results obtained with silico-manganese and with a mixture of ferro-manganese and ferro-silicon*

Heat	Ferro-silicon, lb.	Ferro-manganese, lb.	Silico-manganese, lb.	Total charge, lb.	Carbon, %	Manganese, %	Silicon, %	Manganese added, lb.	Manganese recovered, lb.	Manganese recovered, %
A	160	300	...	31,160	0.26	0.56	0.294	240	174	72.5
B	215	400	...	40,765	0.21	0.57	0.306	320	232	72.5
C	160	310	...	30,620	0.32	0.63	0.312	248	193	77.8
D	160	300	...	30,910	0.27	0.70	0.318	240	216	90.0
E	215	400	...	40,865	0.24	0.72	0.312	320	294	91.8
F	...	40	470	41,010	0.22	0.58	0.308	281	238	84.7
G	...	35	350	30,685	0.26	0.60	0.302	214	184	86.0
H	...	40	470	40,960	0.21	0.64	0.310	281	261	93.0
I	...	40	470	30,510	0.21	0.66	0.303	281	267	95.0
J	...	40	420	36,760	0.24	0.68	0.310	255	250	98.0

*Approximate compositions: Silico-manganese, manganese 53%, silicon 20%; ferro-manganese, manganese 80%; ferro-silicon, silicon 50%. Residual manganese was neglected in calculating recoveries.

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Torpedo-Boat Destroyers

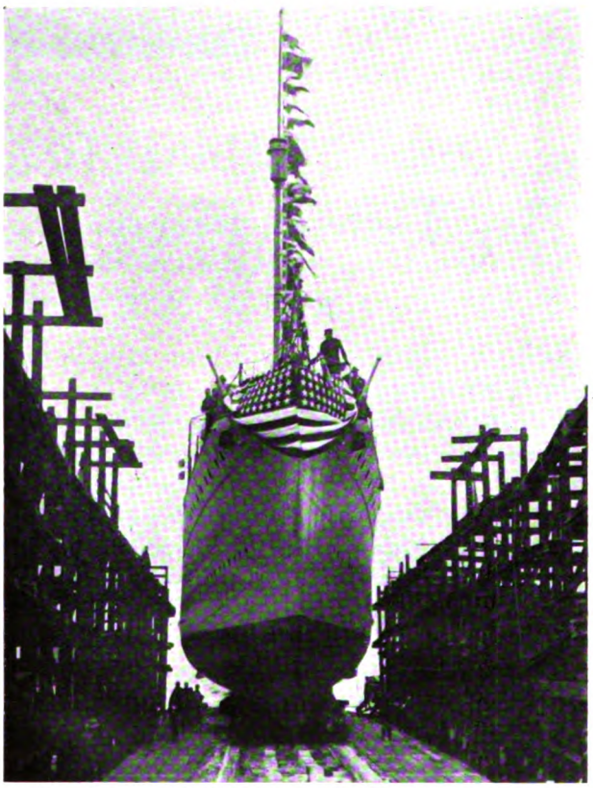
AT a meeting of the San Francisco Section of the American Society of Mechanical Engineers held at the Engineers' Club, April 16, the subject of 'Torpedo-Boat Destroyers' was discussed by Commander James Reed, U. S. N., and Arthur P. Allen, mechanical engineer for the Division of Operations, U. S. Shipping Board. The addresses were illustrated by slides and moving pictures.

While various attempts to use torpedoes were made in the Civil War and even earlier, the first steam torpedo-boat in the U. S. Navy was the 'Cushing', built in 1886. The type of boat was changed several times in succeeding years, mainly to give a larger and faster vessel. Notable steps in improvement included the designs from which several boats were built in 1899, among them the 'Farragut', which was constructed at the Union Iron Works. The 'Farragut' developed a speed of 31.7 knots per hour, and still holds the record for the fastest trip from Mare Island to San Diego, an average of 27.3 knots being maintained between these two points. Much difficulty was experienced in designing a light reciprocating engine fast-running enough to maintain the speeds that were required. A destroyer that went through a four-hour trial trip at full speed without requiring considerable overhauling was a rarity. The first turbine-engined destroyer was constructed in 1906. The first oil-burning destroyer followed in 1908.

The 216 destroyers authorized by Congress in 1917 immediately after War was declared are all of one standard type. They are 315 ft. long, 30 ft. beam, and 9 ft. draft. The weight ranges from 1200 to 1400 tons, according to the amount of fuel and stores carried. The engines developed 30,000 hp., or about the same as a dreadnaught. Furthermore, the engines require only 4200 sq. ft. of floor-space. The vessels are designed for a speed of 36 knots per hour, and have made as much as 39 knots. They carry sufficient oil with tanks full to travel across the Atlantic at a speed of 20 knots per hour. The crew is composed of 136 officers and men. The destroyers cost from $1,100,000 to $1,400,000, according to the yard at which they are built.

The large turbine capacity required is the principal factor in determining the design. In fact, it might be said that the engine capacity to give the required speed is first determined, and then a vessel to contain these engines is designed. Every effort is made to save both space and weight, punches and oxy-acetylene torches even being used to remove metal from webs of interior plates and other members where strength does not require it.

The strength of the vessels as constructed can best be judged by two accidents that occurred during the War. In an oblique collision between the destroyer 'Shaw' and the Cunard liner 'Aquitania', the bow of the 'Shaw' was completely severed and sunk a few minutes later. As a result of the collision, a fire started in the forward oil-tank and damaged the forward part of the vessel. The 'Shaw' steamed backward under her own power until the fire was extinguished and then went into port, also under her own power, where a new bow was constructed and the destroyer was soon back into service. The entire stern of the destroyer 'Manly' was blown to pieces by an explosion from one of her own depth-bombs. The vessel was towed into port, where repairs were made. The destruction of her steering-gear was the only thing



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LAUNCHING THE DESTROYER 'CLAXTON' AT MARE ISLAND, JANUARY 15

that prevented her getting into port under her own power.

Some interesting data were given regarding the construction of the destroyer 'Ward', which was launched at Mare Island Navy Yard 17½ days after the keel was laid, and delivered complete in 104 days. Of the 411,252 rivets required in a destroyer of this type, 183,000 were driven in the stern, bulkheads, frames, and other members fabricated before the keel was laid and dropped into place, and 165,000 rivets were driven between keel-laying and launching. The average number of rivets driven per gang per day was 587.

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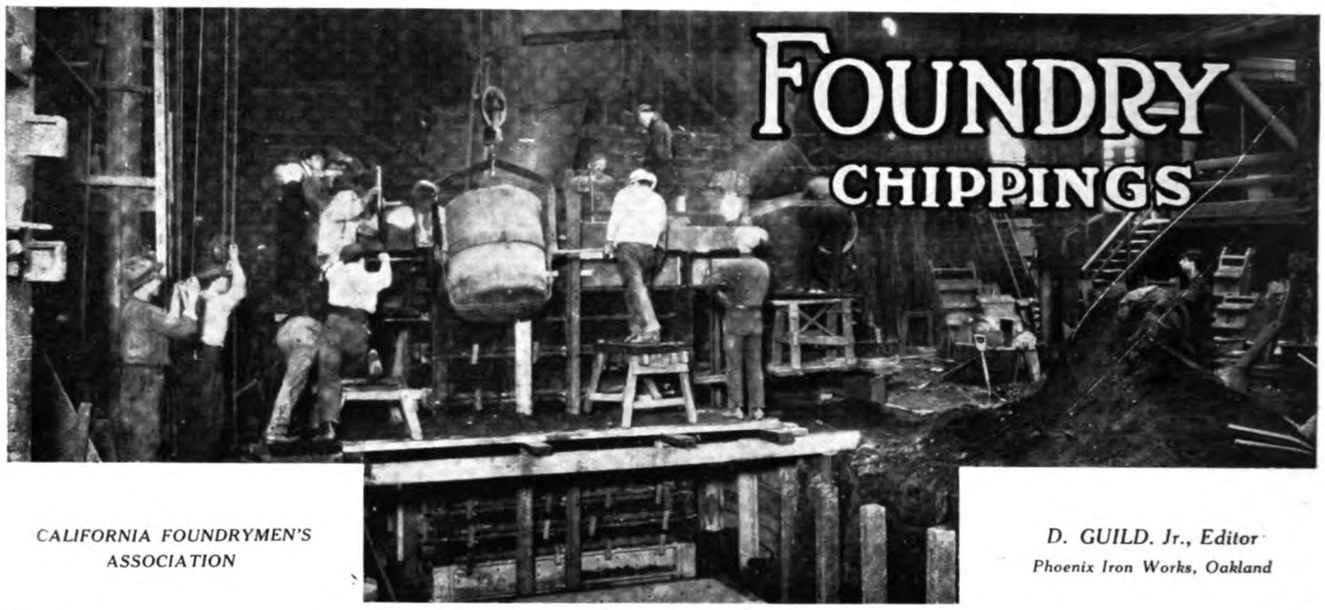

CALIFORNIA FOUNDRYMEN'S ASSOCIATION

D. GUILD, Jr., Editor
Phoenix Iron Works, Oakland

Recollections of the Foundries of the San Francisco Bay District From 1870 Until the Present Time

By A VETERAN FOUNDRYMAN

ACCORDING to my earliest recollections, the principal foundries and workshops around San Francisco bay in 1870 were as follows: the Risdon Iron Works, the Union Iron Works, the Pacific Works, the Fulton Engine Works, the Aetna Works, the Vulcan Iron Works, also known as 'Savages', the Joshua Hendy Iron Works, and the 'Occidental' Works. Besides these leaders in the manufacturing life of San Francisco, it might be of interest to mention other and lesser lights of the local industrial world of that time.

The Atlas works, operated by J. B. Jardine, was later merged with the Pacific Rolling Mill Co., conducted by Mr. Noble. The National works operated by Marshutz & Cantrell, was later carried on under different managements, finally disappearing when Moore & Scott, in whose charge it then was, started ship building. The Golden State Works, operated by Palmer & Knox, whose specialty was mining machinery, was on First street near Market. The Mechanics Foundry was started by J. Leishman. After various changes it was run by John Quinn and others, including W. Leishman and Anderson & Brower, before it finally went out of business. It was operated first near the shot-tower on First street, then at Harrison and Main, and finally at Eighth and Brannan streets.

O'Connell & Lewis started a foundry for 'house work' at the foot of Folsom street on the bulkhead. The columns supporting the dome of the city hall were cast there. This place did not last long.

In the early days stoves and ranges were cast on the Barbary Coast by I. G. Ils. This firm is still in existence but they do not operate a foundry. Also Mixer's foundry ran for quite a period. Another foundry, Llewellyn's, whose specialty was 'house work', made many of the columns for the old city hall on Larkin and McAllister streets. The Low & Chartrey foundry, known among the craft as the 'Frog Pond' made 'house work'. The language spoken in this shop was not as we generally hear it, but if one wanted the crane-man to 'Hoist' or 'Lower' the words 'Monte' or 'Descende' were used, and results were obtained. The Miners foundry was an old established place. In early days it cast the columns for the capital at Sacramento. After some time it was combined with the Golden State foundry. Another old timer is the Eureka Foundry, operated by Thompson Brothers.

Among many others that have played their part and then disappeared, one might mention the American, doing general jobbing work, the Liberty, also a jobbing foundry, Harry Crew's, making gas-engines and printing machinery at North Beach, and Huntington's, making mill machinery.

The Globe foundry on Fremont street made saw-mill machinery and small locomotives, but finally succumbed. Another on Rincon hill made cast-iron pipes in permanent molds, but like many other innovations, this has been laid on the shelf for a long time past.

It might be mentioned in passing that in these old 'house-work' shops, with the simplest of appliances, the

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molders showed an efficiency in putting up a large day's work that, viewed by present standards, would be almost unbelievable.

The MacCormick's Industrial foundry at this time was in Vallejo, but shortly afterward was moved to San Francisco. The owners were in business for many years. It was kept going by the family until recently, but has now passed to other hands.

In Oakland there was but one foundry, known today as the Phoenix Iron Works, which after undergoing some changes of ownership has been run for many years past with David Guild as president.

The brass foundries were only three. Weed & Kingwell's is still carried on by the same families, under the name of Kingwell Bros. The Eagle Brass Works was operated by Mr. Greenberg. His grandsons now keep it going. Last but not least was W. T. Garratt, who made a market for his goods up and down the Pacific Coast as well as attaining an important place here in San Francisco.

For many years he manufactured a large line of steam and other brass goods, and clearly showed that this could be done profitably against Eastern or other competition. This shop also made a specialty in gongs and bells, and some good heavy work was done here about the time the 'Charleston' was built. There was also for a long period an iron foundry connected with this place. W. T. Garratt was a remarkable man in various ways, possessed of great enterprise and confidence, a public spirited man, who had done his bit at Sacramento as a legislator. He had advanced ideas about his workmen, looking on them as he would on his own family. They were principally his own apprentices and his attitude toward them was quite paternal. He was always interested in their welfare. This brass works, like the other two mentioned, still survives under the old name.

It is perhaps not out of place to mention here, what was probably the first steam-vessel built in San Francisco. This early effort was made by an old timer called Johnnie Loughead, a machinist and engineer, a quaint kindly old soul, who built this boat on a vacant lot on what is now known as Nob hill, putting the vessel on a truck and launching her near the foot of Powell street. She was fitted with an engine and used around the bay afterward. This was long before 1870.

The kind of work done in the early 'seventies was largely mining machinery, quicksilver furnaces, heavy pumps, saw-mill machinery, and some shipbuilding. For instance, at the Risdon Iron Works a vessel, the 'Mexico', of about 2000 tons, was built and also fitted with engines. This steamer was used on the Pacific Coast for many years. Another, the 'Bolivar', an iron ship, was cut in two and lengthened, making her quite a vessel. At the Risdon Iron Works, in the early 'seventies, a low-pressure cylinder 9 ft. diam., 12 ft. stroke, and weighing 25 tons, was cast for a Pacific Mail steamer, the 'Arizona'.

The Dickie brothers at this time and for many years afterward were prominent in this industry. During this period the Risdon Iron Works filled many large contracts for heavy mining and pumping machinery, all of a first-class character, calling for highly skilled mechanics, with which this shop was well supplied, most of them coming from that cradle of engineers and shipbuilders, the Clyde.

The Union Iron Works was the leader for many years in the manufacture of mining machinery, which was shipped to all Pacific Coast points and States nearby; also to faraway places, such as South America, Korea, Australia, New Zealand, and even to Africa. In these early days, many steam-engines were built by the Union for various duties, particularly pumping and hoisting. Some of these were of a large caliber, notably those for the Comstock, weighing up to 20 tons. The machinery for the first cable-road in the world, (the Clay Street line) was made there. Locomotives also were built there including many of those running on the Donahue road. This work was followed for many years and a large amount of work was produced at the shop, which at that time was situated on First and Mission streets. Upon moving to the Potrero, shipbuilding was commenced under the direction of I. M. Scott, whose great genius and enterprise enabled him to build ships of a heavy type and of first-class quality, including both naval vessels and merchant ships, among them being the 'Charleston' one of the first, also the 'Monterey' and the famous 'Oregon'.

Besides these two pioneer shops, there were several others such as the Pacific works, operated by Rankin & Brayton, and making engines and pumping and mining machinery both for the Pacific Coast and for Mexico. The Pacific concern at one time operated a foundry on Rincon hill for the manufacture of soil-pipe, but afterward discontinued it. This firm has long since gone out of existence. Another shop was the Aetna works, which made mining and other machinery with an occasional towboat. This concern has also gone out of business.

Another shop was the Vulcan works, also known as 'Savage's', which did general work, 'house work', city work, and also made saw-mill machinery, soil-pipe, and fittings. This place has also long since passed.

The Fulton Engine Works occupied a prominent position in the old days, doing all classes of work. When steam-schooners began to replace sailing vessels, it was the leader in this industry, building and fitting out a large number, many of which are today doing good service on the Coast. This shop has gone the way of many others, and is only a name today.

In the Potrero the Hope works owned by Mr. Hanscom, had at that time as superintendent G. E. Dow, the well known pump-builder.

At this same period there were other foundries that confined themselves to the working of cast-iron alone. Only two or three of these now survive. At that time, all of them appeared to have plenty of work with little slack time. Everyone had work that wanted it. Wages were not as high as at present, but the conditions of life

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were easy and pleasant; food and other necessities both cheap and good. This situation continued until the great strike of 1891 gave the metal industry its first great blow. The strike lasted long enough to enable outside places to get control of the mining-machinery and other iron industries, which have not been recovered by California since. This disastrous strike, curiously enough, was not for hours or wages or any union principle, but apparently was caused by unrest and dissatisfaction, which culminated in a strike at one of the shops over a limitation of work. The long struggle left both sides much exhausted, but apparently the union-labor men suffered the least. During the fight, they undoubtedly endured privations in spite of the vast sums of money poured into the city for their relief. On the side of the manufacturer, however, the injury was deep and permanent and is felt to this day. Since that time there has been a chronic struggle between the employer and employees; the former endeavoring to hold what he had, and the latter making demands for shorter hours and better conditions and in nearly ever case getting what he asked for after more or less disturbance, but at the expense of the industry and frequently at the expense of his own best interests.

After the strike of 1891 which caused us to lose out on mining machinery, there appeared to be no particular leading line of work. However, the building of steam-schooners with the necessary equipment for such vessels, and the manufacture of irrigating pumps, steam-pumps, gas-engines, mostly marine, pipe-fittings, stove-plate, and some specialties, has been the cause of many new shops starting business on both sides of the Bay. A few of these are mentioned below.

The Enterprise foundry has several shops casting brass, steel, and iron. 'Nothing too hot or too heavy' is their motto, and the name 'Enterprise' is appropriate. The Pacific foundry is not so old, but does a large business in pipe-fittings and smelting and acid machines. The Dow Pump & Diesel Engine Co. has been established for a number of years. In the Jewel Steel & Malleable Co., two of our young men, A. Haase and W. Lauten, are interested. Other malleable plants have started in the past but they were unable to stand the pressure brought to bear. This one, however, will stick for sure. The Golden State & Miners Iron Works is situated at the old stand on First street and is now principally engaged in the dredger industry. It is conducted by W. Palmer. The Oakland Iron Works manufactures an excellent line of goods. The Joshua Hendy Iron Works makes a long list of hydraulic and mining machinery and is now building marine engines of large capacity. The H. C. Macaulay Foundry Co. makes irrigating pumps and gas-engines, and recently has done a great amount of aeroplane-engine work. The remarkable success the management has attained in this difficult work speaks volumes for their perseverance and fortitude. The founder of this concern was Byron Jackson. Thompson Bros. continue to make pipe-fittings and to do a general jobbing business. In Oakland, there is the Skandia Pacific Oil Engine Co. and the Standard Gas Engine Co. In the North Beach, there is the Vulcan Iron Works, the old name but new people interested. The work is about the same as before. The Rudgear-Merle Co. and the Rincon Foundry Co. both do mainly architectural work. The Western Foundry Co. does marine work and general jobbing.

One other foundry may be mentioned, the Occidental, operated by Steiger & Kerr, and doing general foundry work, as well as manufacturing stoves extensively, showing for many years past that such work can be done on this Coast, in spite of Eastern competition. This place is remarkable from the fact that it is now under the same management as it was 50 years ago, which cannot be said of any other foundry in the Bay district. J. W. Kerr, the president, stands in the remarkable and unique position of being the only survivor of the many who were in the business before 1870. Surely we may all unite in congratulating him on the good work he has done and the endurance he has shown in the strenuous and trying life of a foundryman for fifty years.

After many years, another business has come to life, which in importance and capacity completely eclipses all of the doings of the earlier years. This is a continuation of the shipbuilding industry, established by I. M. Scott. An extract from the San Francisco 'Chronicle', January 2, 1914, in the 'twenty-five years ago' column is as follows:

"Prosperity among shipbuilders on the Pacific Coast was reported. Twenty-nine steamers had been built in the last year. The Union Iron Works employed 1300 men and was completing the cruiser 'Charleston'."

Shipbuilding has grown to huge proportions, employing thousands where hundreds used to be. The Bethlehem Shipbuilding Co. employs thousands of men at both the Union and the Alameda plant. In addition to this there are several other extensive yards including the Moore Shipbuilding Co., the Hanlon Drydock & Shipbuilding Co., the Schaw Batcher Shipbuilding Co., the Union Construction Co., and the Pacific Coast Shipbuilding Co. This again places San Francisco on the map as a manufacturing centre, but the lesson of 1891 must not be forgotten. In spite of all the costly equipment and the millions of dollars that are invested in these shipbuilding establishments, the same methods that were pursued in 1891, namely, 'labor troubles', will kill shipbuilding as effectively as the mining-machinery industry was killed 28 years ago.

THE soup was painfully weak. The piano-mover inhaled a few spoonfuls and demanded to know what it was made of. "That's beef broth," replied the waitress. "Thanks for the information," said the piano mover. "I thought you had served me the water that the eggs were boiled in."

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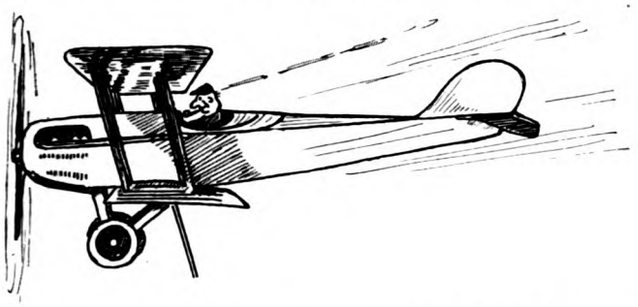
Trade Notes

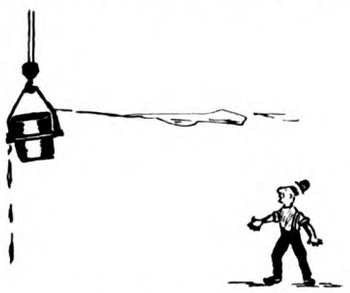
A mechanic was up from a country shop to find out about this here Saturday half-holiday. He says that the half day is a good thing, but with prohibition hitting us in July, a fellow might just as well work.

A paper published across the bay in the interest of labor is called the 'Tri-City Weekly'. Some day the



printer will make a mistake in spelling either the word try or weakly.

The nomination list is out for the San Francisco Chamber of Commerce directors, and with pride we note that out of 21 names proposed only one represents a Metal



HOT IRON IN 1920

Trades Industry. This is a great showing for an industry that represents one-third of the population of this district.

Our Fessy was out to the Pacific the other day to take a photograph of the big cylinder they were pouring. After setting 'em up, he held a flask-lamp aloft like the Goddess of Liberty and blazed away. When he developed the plate he found a dark spot in one corner that looked something like Charley Kellie yelling for feeding iron.

How would it do to let San Francisco arrange her own labor affairs. First we listen to Uncle Sam, then to the Northern shipyards, then to Washington again, and now to the North again on May 5. Why not give us a chance?

Why don't some one work up another banquet or smoker or beer-bust. It's been a long time, and July is coming fast. Sic 'em, Nate and Charley.

Some fellows are scratching their heads to find out why it cost the machinists over a hundred dollars to get the half day and it didn't cost the molders a cent to get laid off all day.

Only two new core-oils reported last month.

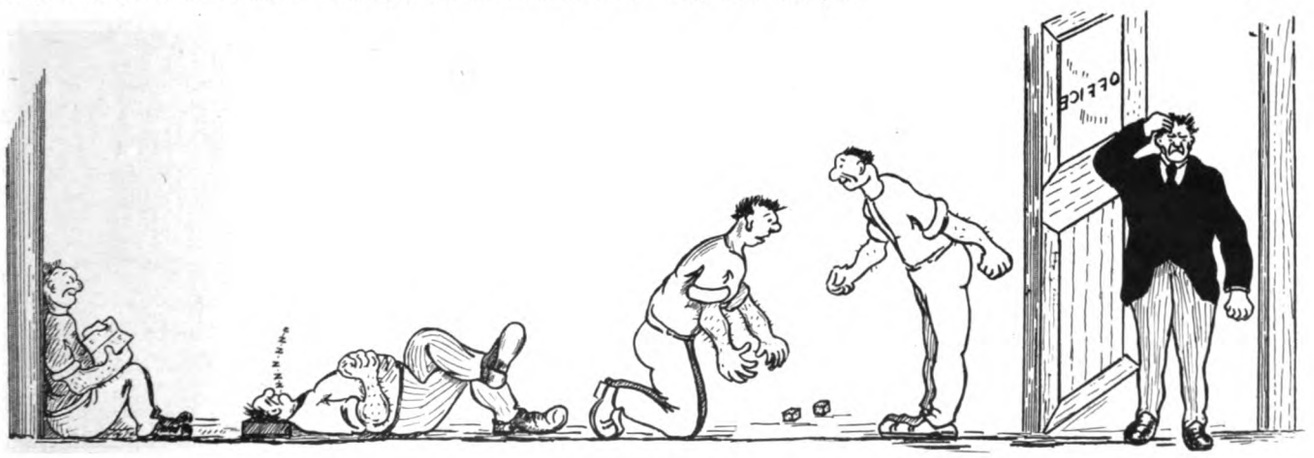
Secretary Thille went north last week to the Metal Trades Convention.

A goodly amount of unnecessary worry is experienced in some quarters because after April first no plan is provided to take the place of the Macy Board in the adjustment of labor matters. So far as this district is concerned it would not be a bad idea to split up the Board into shingles, lath, or anything that will burn well; after careful ignition and further cooling, the ashes could be carefully gathered up, a tug chartered and these ashes could be scattered up and down the coast with appropriate ceremonies. We can have almost as many strikes without any Board at all, and we can stay home and watch 'em.

An amusing incident occurred at a recent Association Meeting; Friend Kingy had a plan to put over which he said was a good poker play. In the discussion that followed, John Hedley nearly trumped his partner's ace; Clarence Henderson lead the right bower and Jim Kerr took the trick with the joker; but Davie Guild in the chair said it was a misdeal and all bets were off. Later, Kingy said it wasn't poker he was thinking of—he never played it, because in his business the favorite game was "Going to Jerusalem."

Ice cream is alright in a dish; but it stands alone as being one of the few ingredients not recommended as a core binder.

Castings don't cost a cent less to make nowadays, but they sell cheaper.



BLAST TIME

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Soaking Iron in the Cupola

By C. M. HENDERSON

The latest contribution to the store of knowledge in the iron-foundry industry is 'The Metal Mixer', written by a well known Californian foundryman, W. W. Ellis, foundry superintendent for the C. L. Best Gas Traction Co. In compiling this little volume, Mr. Ellis has endeavored to simplify the subject of analysis of cast-iron so as to make its meaning clear to every studious young mechanic and to teach him by a simple and comprehensive method to become a master of the cupola, capable of producing any of the desired mixtures for various purposes.

Many examples are shown and various mixtures proportioned, which give evidence of the writer's ability and of his thorough knowledge of the subject. The most suitable mixtures for various kinds of castings made in Californian foundries are given, and their analysis is properly determined from available materials. In the concluding chapter, Mr. Ellis touches lightly upon the subject of cupola practice, and with but one exception, I am in accord with his manner of operating it. He states, "It is not very good cupola practice to let the iron soak too long in the cupola before starting the blast as the iron absorbs more or less sulphur from the fuel during that time."

This is a mooted question well worth a thorough investigation by every foundryman. An unbiased investigation would cost nothing and would convince many that a reasonable soaking has advantages and no disadvantages. The majority of melters agree with Mr. Ellis in starting the blast as soon as the cupola is filled to the charging-door in the belief that any further delay will permit the iron to absorb sulphur from the fuel and also that the fuel is being burned away and wasted.

Authorities like Thomas D. West and Richard Moldenke agree that the iron should soak from one to two and one half hours after the cupola is fully charged. The latter states that one hour is good practice but that two and one-half hours is better. Being interested in a discussion of this subject, about a year ago, before the Foundry Foremen's Club, I did some experimenting to ascertain at first hand whether soaking iron had merit or not, and the result showed on every count in favor of a reasonable soaking. Iron will not begin to melt in the cupola until after the blast is put on and has no affinity for sulphur until it becomes molten. In the latter state it will readily absorb sulphur until its temperature approaches 3000°F. and at a higher heat will expel much of this absorbed sulphur.

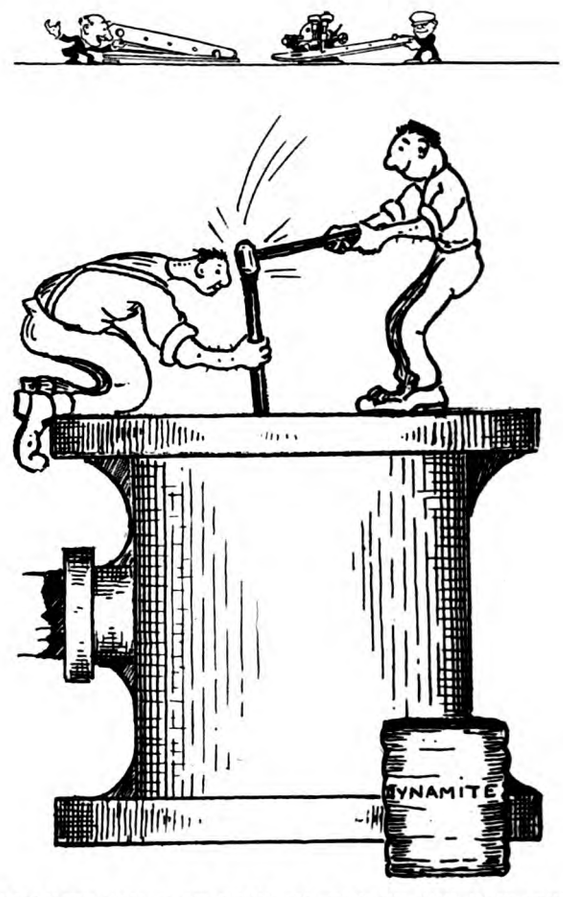
An analysis of the first iron melted will show an increase of from 30 to 50% in sulphur over the general average of the mixture and the sulphur will be high whether the iron has been allowed to soak or not. This was demonstrated by analyzing the first iron that appeared in comparison with samples taken from ladles containing the first full charge.

This high sulphur found in the first iron is attributable to the fact that it represents principally the lighter pieces of scrap, with the added sulphur derived from the coke in the bed, and the further reason that the hearth is not yet sufficiently heated to expel any sulphur.

During the time a charged cupola is standing, the coke is to some extent, being burned away, but this by no means represents a waste; on the contrary, nearly every unit of heat is being absorbed, either by the stock or by the lining. In both cases this is beneficial, as every foundryman knows a hot cupola or blast-furnace produces the best metal.

It may be readily observed that little heat rises above the charging-door in a fully charged cupola until after the blast is put on, but thereafter the heat lost is excessive. This is the reason for having charging-doors on modern cupolas placed as high as the coke-bed will sustain the load, in order that the charges may absorb as much of this waste heat as possible before arriving at the melting-zone.

Letting the cupola stand a sufficient time ensures a good heating of the lining and hearth, and the first iron will be hot enough to pour almost any mold instead of being used merely to heat ladles. This practice also ensures having the cupola ready at the foreman's command if he desires to start pouring earlier than usual, without in any way interfering with the furnace-men's regular routine.



DYNAMITE SQUAD AT WORK ON ONE OF OUR NEW CORE MIXTURES

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Core Mixtures

It is interesting to note the changes that have taken place in the core-rooms of the foundries on the Pacific coast in particular during the last two years. Extra efforts have been made and interest shown in the core-room toward obtaining a suitable core-sand mixture. It has always appeared to those connected with that department of the establishment that the core-room was looked upon as a necessary evil and therefore received little consideration. As has been quoted, "A cored hole in a casting costs money to make for which the foundryman received nothing in return."

While some core compounds have been used on the Pacific coast for the past ten years or so, the supply-man has found it an up-hill job to interest the foundryman sufficiently to use them. The standard mixtures two years ago could be counted upon the fingers of one hand and nobody dared to deviate from the formula. The mixture for the large cores was:

2 parts sharp sand,
1 part red sand,
1 to 10 of flour.

The standard for the small cores was:

7 parts sharp sand,
1 part flour.

A few of the shops were using the black compound on plain or bulky cores, but, taken as a whole, it did not make much of a hit at that time. Sharp sand and linseed oil were used exclusively for jacket and intricate cores, some preferring raw oil and others boiled oil and occasionally litharge. Anybody that had mastered the so-called hidden secrets of oil-sand was looked upon as some core-maker.

When the price of linseed oil soared and when Uncle Sam restricted the use of flour in the foundries, it had the effect of placing the long neglected core-room in the limelight. At the same time, castings of a more intricate and complicated design were demanded, such as steam and gas engines, pistons, valves, condensers, pumps, and turbines, while such things as columns, bases, manholes, hoppers, and cesspools were shelved. More of these costly empty places in the castings were required and a heavier burden was placed on the core-room. To do this work without the old standard mixtures, however, appeared to be out of the question.

It is amusing to look back upon the molder that was positive he could not make a casting without trying flour on the joint for a 'touch', and that it meant simply ruin to refuse him paste to avoid a run-out. This looked black enough for the molder, yet how were the castings going to be produced to help lick the Hun if Uncle Sam refused flour to the core-maker?

Well, the Hun had to be licked, and the castings had to be produced without flour, that's all. It simply shows what can be done, what ideas can be brought forth, when one is forced to it. It would be impossible to compile a complete list of the different core mixtures that were being used during the war-time period, and while the restrictions on the use of flour in the foundries are now removed, it appears that many of the shops will continue to produce cores without flour. The mixtures composed of the various compounds and oils on the market today were determined only after much worry, time, and experiment, and many of these mixtures have proved successful. The ancient mixture of black sand and sawdust that Mr. Bailey of Mare Island championed before the foundrymen on several occasions did much toward lessening the burden on plain cores, and while it met with some opposition, it was not overlooked by the wise ones and will continue to be used.

Flour was meant for food, and is considered the staff of life. I look forward to the day when its use, or rather waste, in the foundry will be restricted, if not entirely cut out. It can be done; this has been proved. Its curtailment in the foundry has been for a purpose and this purpose has been realized. Yet, whether you and I agree on prohibition of flour in the foundry just now, or stale beer for a mold-wash after July 1 matters little.

Things will happen. We'll discuss that later. Let's finish that other job first. How about it, Brother, 'Did you Subscribe?'

JOHN.

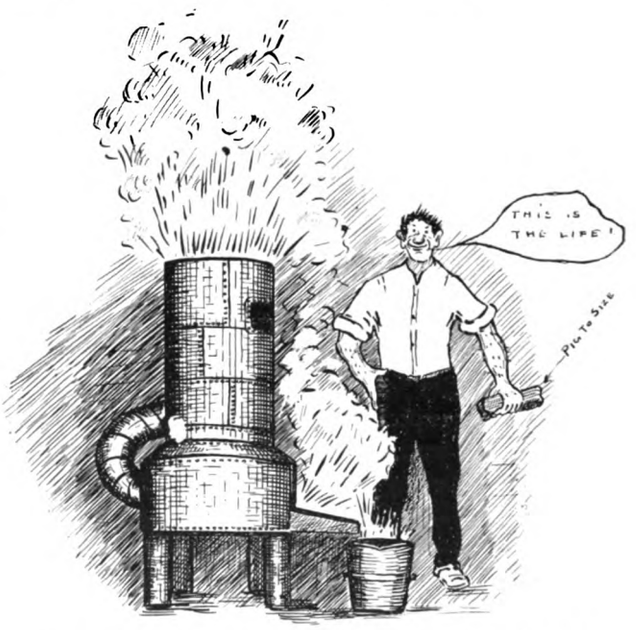
HE was a furniture-mover's man and his memory, as he cheerfully admitted, was very convenient.

"No; I can't remember where Mr. Slyflit has taken his family and furniture."

The collector produced $2 and tendered it.

"That ought to rouse your memory," he remarked.

"It ought to do so, sir," he admitted, "but you see this ain't no ordinary memory an' it'll take a deal o' rousing. Why, it cost $2 to put it to sleep."



SUGGESTION FOR THE SATURDAY HALF-DAY CUPOLA

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THE SATURDAY HALF-HOLIDAY

Mr. William Kingwell,
Editor Chippings.
Dear Kingy:
OF COURSE your shop
IS IN the Mission and
YOU CAN'T be expected
TO KNOW what is
GOING ON so well as
A FELLOW who works
ON THE flat or in
MY CITY Oakland but
YOU SURELY must have
HEARD OF this new
SATURDAY HALF-DAY
IT ISN'T really funny
BUT IT is peculiar
AND IT makes a
FELLOW SCRATCH his head
BECAUSE YOU will
REMEMBER KINGY that
WE RAISED wages and
GAVE SPECIAL conditions
AND SCRATCHED around
AND WORKED our fool
HEADS OFF to pay these
HIGHER WAGES which were
NECESSARY BECAUSE of
THAT H. C. L. guy
AND NOW when things
ARE GETTING really slack
AND ORDERS are scarce
AS A smile on the
FACE OF a boss machinist
ALONG COMES these
LABOR GUYS holding
HANDS WITH Uncle Samuel
AND THEY says real
SUDDEN AND casual like
THE TROUBLE is not
SO MUCH this H. C. L.
AS IT is T. M. W. which
IS FRENCH for too
MUCH WORK and of
COURSE IT will cost
US FIFTEEN bucks a month
BUT A man must play
AND WE will put
IN THIS half-day by
FIXING THE baby carriage
AND DOING odd jobs
AROUND THE house unless
OF COURSE you want
US TO work over time
AT DOUBLE time or so
OF COURSE Kingy a
GOOD YELLOW brass shop
WON'T FEEL it so much
'CAUSE A brass shop
IS SOMETHING like
A CHATTERBOX bakery
AND THE castings kind
OF ROLL out like cakes
FROM A hot skillet
AND IT can be stopped
AT ANY time and
THE SOONER the better
AND THEN you can't
BLAME A molder from
STAYING AWAY from a
BRASS SHOP for half
A DAY a week even if
IT DOES cost him half
THE PRICE of a good
AUTO TIRE a month
IT'S WORTH it anyway
BUT IN an iron foundry
IT'S DIFFERENT Kingy 'cause
IT'S BIGGER and the
BOSS NEEDS time to
GET HIS doll clothes
TOGETHER AND get his
PARTY GOING—he isn't
USED TO COMING down
AND OPENING his mail
WITH ONE hand and putting
ON THE blast with the other
AND IN a few minutes
IT'S NOON so there you are
WELL KINGY if you know
OF ANY place where it
WORKS OUT to good advantage
PLEASE PUBLISH it in
YOUR LITTLE paper so
ALL CAN hear about it
BUT IT looks to me
THAT IN the end
AND WITH orders and
PRICES WHERE they are today
THE BOSSES HAD BETTER join
THE T. M. W. club too
AND MAKE it a
FULL DAY Saturday so
EVERY ONE can sit around
AND ENJOY the silence
TOGETHER LIKE—'cause
EVEN THE good book
TELLS US to work six
DAYS KINGY and it
WOULD HAVE listened
FUNNY WOULDN'T IT
TO HAVE read—that
FIVE AND one half days
SHALT THOU labor and
DO ALL thy work
WITH IT all there is
ONE SURE thing
KINGY OLD boy and
THAT STICKS out all over
NAMELY to wit that
THE NINETEEN nineteen
INCOME TAX from the
METAL TRADES shops in
THIS DISTRICT WILL be
SO SMALL even the
COLLECTORS CAN'T see it.
I THANK you
CASEY BEE.

Philadelphia Foundrymen Hear So-called Inventor

Our friends of the Philadelphia Foundrymen's Association have been having a little harmless amusement at the expense of one William H. Hoffman, a promoter who claims to have discovered a mixture of 'amphibole asbestos, actinolite, and Hoffman compound' that can be used in place of molding-sand and make it look like a back-number. The particular idea is that molds made of this stuff would be permanent, so that on repetition work, the molder would be out of a job after the first mold was made. Mr. Hoffman had gone so far as to establish a stock-selling office in Philadelphia handling shares of a fancy company in which he held the proverbial 51% of the stock. The Association was kind enough to call a meeting to hear Mr. Hoffman on April 2, accounts of which were published in the Philadelphia papers of April 3. Apparently the great inventor was there with promises, but shy on anything that approximated a practical test. We presume that stock-selling in Philadelphia has now become rather difficult. California foundrymen will regret that the State blue-sky law will probably make it impracticable for the worthy inventor to come West and give us a similar entertainment to the one he unintentionally gave the Philadelphia Association.

"I SEE by the papers that Pat was drowned. How did it happen in spite of the fact that he was a good swimmer?

"He was a good Union man, too, and he fell in just as the whistle blew and he wouldn't work overtime."

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Trade Notes

The General Wood Preserving Co. will construct a $250,000 creosoting plant at Bay Point.

The General Petroleum Co., Higgins Bdg., Los Angeles, is making inquiries regarding equipment for a large shop which is to be erected soon.

The U. S. Shape & Pipe Bending Co. has delivered two of its 8-inch machines to the Schaw-Batcher Shipbuilding Co. and to the San Francisco Shipbuilding Company.

C. J. Albert, district manager for the **Cleveland Pneumatic Tool Co.,** is showing an industrial film of the Cleveland plant of the company. Methods of manufacture are shown in detail.

The Kroyer Manufacturing Co., of Stockton, will start work on its tractor factory about June 1, and expects to have the new Wizard Four-Pull tractor on the market early in the fall.

Contracts for the construction of 25 steel steamers for the Emergency Fleet Corporation by **Skinner & Eddy,** of Seattle, which were suspended some time ago, have been reinstated.

The General Motors Co., which purchased the plant of the **Samson Sieve Tractor Co.** at Stockton a year or so ago, has bought a block of land adjacent to the plant and will enlarge its capacity.

The **Rix Compressed Air & Drill Co.** has moved its main manufacturing plant to 409 East 3rd street, Los Angeles. The head office and a small shop are still maintained at 505 Howard street, San Francisco.

Robert W. A. Brewer, who for the past four years has been inspecting engineer for the British government at the plant of the Holt Manufacturing Co. at Stockton, has opened offices as a consulting engineer at 503 Market street.

L. E. Helm has purchased the interest of his partner, M. E. Quinn, in the **Marine Electric Co.** Mr. Quinn is retiring from business and plans to take a European trip to benefit his health, which has been poor for some time.

The Best Gas Traction Co., San Leandro, has added a Sheppard 5-ton electric overhead traveling crane to the equipment of the assembly shop. The crane has a span of 47 ft. and is equipped with an entirely enclosed trolley.

Pawling & Harnischfeger Co. of Milwaukee opened offices in the Monadnock building during April. **Robert M. Taylor** is the western manager. The principle lines handled are cranes, hoists, grab-buckets, and appliances for foundries.

A. L. Martin, district manager for the **Liberty Steel Products Co.,** left for Chicago the latter part of April to attend the Foreign Trade Convention. He expects to go to New York and Pittsburgh before returning to San Francisco.

After May 1, **Henry F. Jurs** will handle the business of The Geometric Tool Co., of New Haven, in the western States and part of the Orient, under the name of The Tool Equipment Co., with offices for the present at 735 Folsom street.

The Willamette Iron & Steel Works, of Portland, has been awarded a contract for furnishing boilers for four 8800-ton steamers now being built at Shanghai by the Kiangnan Dock & Engineering Works for the Emergency Fleet Corporation.

Leeds & Northrup Co., of Philadelphia, have issued a bulletin on 'Checking Thermo-couple Pyrometers'. It discusses the importance of maintaining standards and of checking pyrometers. It points out sources of error and the remedies for troubles in thermo-couples, millivolt-meters, cold junctions, and potentiometers. A commercial checking laboratory is described, including a special checking furnace, precision potentiometers, and standardized thermo-couples.

An election will be held at Sacramento in the latter part of May to vote on a bond issue of $2,400,000 for the construction of a filtration system for the municipal water supply. Water will be pumped from the Sacramento river as heretofore.

The name of the **Leland Equipment Co.,** 126 Pine street, San Francisco, has been changed to **W. H. Worden Co., Inc.** The address, management, and personnel of the new company will remain as heretofore. The principal line is logging equipment and belting.

Contract for moving the Pingree sugar mill from Visalia to Ogden, Utah, has been awarded to **Gutleben Bros., San** Francisco, on a cost-plus fixed-sum basis. The beets formerly handled at this mill will be turned over to the Corcoran refinery, which is owned by the same company.

The U. S. Railroad Administration has taken over 285 cranes from the War Department, and they will not be thrown on the market as was anticipated. However, this will probably supply the needs of the railroads for some time to come and keep them out of the crane market.

George E. Long, vice-president of the **Joseph Dixon Crucible Co.,** spent the month of April touring the State with A. C. Bowles, district manager. The trip made him a booster for both the highways and the climate. He echoed the statement that $5000 a year here is worth $20,000 in the East.

The Pacific Alloy & Steel Co. has been incorporated with a capital of $2,500,000 to take over the **Pacific Electro Metals Co.** The plant at Bay Point will be enlarged. The directors are J. M. Kroyer and F. B. Nims of Stockton, and W. H. Metson, C. D. Clarke, and H. A. Koster of San Francisco.

L. T. Harper of **Shields, Harper & Co.,** exporters, has recently returned from India and reports that there are wonderful possibilities there for the sale of American machinery. The freight rates, however, are in favor of the Atlantic ports. If these were equalized there would be a big movement of freight out of San Francisco.

The Great Western Power Co. has received permission from the California State Railroad Commission to issue securities having a total value of $7,500,000. This will provide funds for the construction of a 40,000-kilowatt powerplant on the Feather river near Belden, preliminary work for which has already been started.

Tractor entries for the **California Tractor and Implement Association** meet, which is to be held near Sacramento, May 6 to 11 have been closed because the available space has been exhausted. Entries of 61 types and sizes of tractors as well as over 100 entries of trucks, carbureters, magnetos, and other accessories have been received.

The Laminated Shim Co. has issued a booklet describing Laminum, a metallic shim composed of laminations of thin smooth brass held together by a metallic binder. It has the advantages of a solid brass shim and is accurately adjustable in thickness. The **Mazura Manufacturing Co.,** 412 South Sixth street, St. Louis, has the Pacific Coast territory.

Vernon Job of the **Independent Pneumatic Tool Co.** is making a drive on Red Devil rivet-cutters. This is a pneumatic tool designed to cut and back out rivets. The tool is practically a hammer traveling in a long barrel and delivering a heavy blow on the chisel-head. It will cut 1¼-in. rivets cold in ten seconds. The tool weighs 54 lb. and is operated by three men.

Fred C. Metcalf, secretary of the California Metal Trades Association, is in New York attending the 15th annual con-

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vention of the National Metal Trades Association. He will be back in San Francisco about May 10. Although the Western associations are not members of the National Metal Trades Association, the secretaries of these organizations were invited to attend the convention.

The Iron Trades Council has elected the following officers for the ensuing year: president, Robert W. Burton; vice-president, W. H. Kleinhammer; secretary-treasurer, Frank C. Miller; trustees, George Cullen, A. G. Atwood, and D. J. White. Messrs. Burton, Kleinhammer, and Miller have been elected delegates to the Pacific Coast District Metal Trades Council, which meets at Oakland on May 5.

The Columbia Steel Co. has been awarded the contract for all the steel castings for four battleships to be built by the U. S. Navy. Three of these ships will be built at Eastern navy yards, and the fourth probably at Mare Island. The company has also obtained the manufacturing and selling rights for the Pacific Coast for the Baldt Stockless Anchor and is now making these anchors in large quantities.

Plans are being made for the enlargement of the present **San Joaquin Valley Milk Producers Association,** of Fresno, to include all the creameries of the San Joaquin valley between Merced and Bakersfield. This will give the Association a capital of about $1,000,000. A plant will be built at Tulare for the manufacture of milk products such as sugar milk, casein, albumen, condensed milk, and powdered milk.

'A Systematic Solution of the Belting Problem' is the title of a booklet describing methods and apparatus for that purpose made by the **Tabor Manufacturing Co.** of Philadelphia. The principles of belt transmission are discussed and rules for the selection of belts, getting the proper tension, and for the care of belts are given. The belt-bench, tension measurers, lacing, cutting, and scarfing machines are shown in illustrations and described.

Thomas R. Heyward Co. has leased the Maxwell warehouse on the Alameda side of the estuary, a block from Webster street on the Southern Pacific tracks. The warehouse has 6000 ft. of floor space and will be used for the storage of carbide, manufactured by the Canadian Carbide Co., for which the Thomas R. Heyward Co. is exclusive agent on the Pacific Coast. J. C. Redman, manager, whose offices are in the Rialto building will shortly lease a warehouse in San Francisco in which a large stock of iron, steel, and alloys will be carried.

A. W. V. Johnson, sales agent, Merchants Exchange Bdg., is establishing a machinery department in addition to his oxygen apparatus lines. He now represents manufacturers of complete oxygen and hydrogen generating plants, high pressure steel cylinders, cutting and welding equipment, etc. The pulmotor resuscitation devices made by the Draeger Oxygen Apparatus Co. and the Paul Breathing Apparatus manufactured by the American Atmos Corporation are also handled by Mr. Johnson. The Paul oxygen helmet is the latest word in breathing apparatus for use in mines and fires. The inventor, J. W. Paul, has been in charge of the rescue work of the U. S. Bureau of Mines for many years.

The Pacific Coast Shipbuilding Co. has developed a remarkably efficient safety organization at its yard at Bay Point. There are four committees, as follows: The men's committee, which changes monthly, and which makes monthly inspections of the yard and forwards recommendations to the central committee. The foremen's committee serves three months, and makes quarterly inspections of the yard and forwards recommendations to the central committee. The central committee is composed of W. H. Brierly, the safety engineer, who devised the plan, and the other superintendent. This committee has charge of carrying out safety measures. The advisory committee, composed of the officers of the company, is consulted when necessary.

The American Malleable Castings Association, of Cleveland, has issued a booklet on 'Malleable Iron' that should be in the hands of every maker and user of malleable iron. While great progress has been made in the industry during the past few years, there has been little published data available. This new treatise, which is to be followed by a more comprehensive volume supplies this lack. It is divided into three parts, as follows: Part I, What is Malleable Iron? Part II, The American Malleable Castings Association. Part 111, The Uses of the Malleable Iron Castings. Can Heavy Sections of Malleable Iron Be Completely Annealed? The Skin of a Malleable Iron Casting. Malleable Iron Castings Resist Rust.

Herberts Machinery & Supply Co., with head-offices at 3rd and San Pedro streets, Los Angeles, has opened a branch office and show-room at 168 Second street, San Francisco, under the management of B. J. Flanagan. A large stock of machine tools are carried at both offices. Among the concerns represented are the Cincinnati Shaper

Above, Los Angeles Office, and Below San Francisco Office of Herberts Machinery & Supply Company

Co., Rockford Milling Machine Co., Rockford Drilling Machine Co., Rockford Tool Co., Hamilton Machine Tool Co., Rahn Larmon Co. (engine-lathes), Merrill Manufacturing Co. (pipe machines). A force of salesmen traveling from the two offices will cover the entire State. Mr. Herberts has conducted the Los Angeles house for the past five years, which has, by the way, one of the finest locations in the machinery district. Before going into business for himself, Mr. Herberts sold machinery in the East, and also for a number of years managed the machine-tool department of a large Pacific Coast house.

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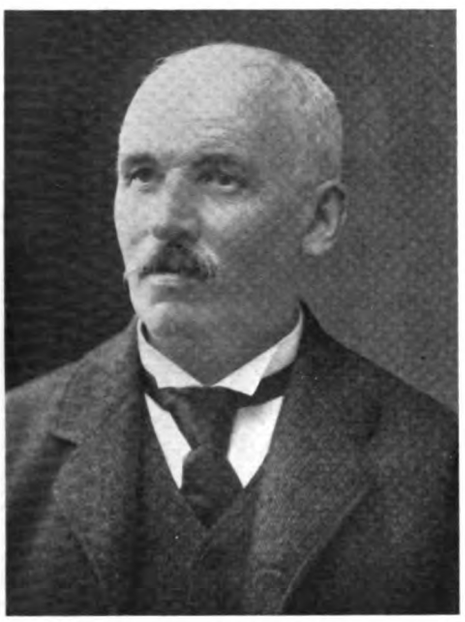
Obituary

David Dorward, Sr., died April 6 at his home at 1242 Bay street, Alameda. Like so many others among the pioneers of the metal industries of the San Francisco Bay district, Mr. Dorward was a native of Scotland, being born in the same town, Arbroath, as his friend and associate during many years, the late George W. Dickie. In 1871, at the age of 21, he came to America, spending two years in the mechanical department of the New York Central railroad at Rochester, New York. He then came West, and entered the employ of the Risdon Iron Works, which association continued during the greater part of his life, most of which time he was general superintendent for the company. When the Risdon Iron Works went out of business about ten years ago, he organized and became the head of the Dorward Engineering Co., with offices at 503 Market street, San Francisco, representing also the Heine Safety



David Dorward

Boiler Co. and the Petroleum Iron Works. He continued in active charge of the business of the company until three days before his death. Mr. Dorward had charge of the construction of the machinery for the first cable street-railroad in San Francisco, also of the first electric railroad machinery in that city and also in Oakland and Alameda. Among other important projects with which he was connected may be mentioned the construction of pumping machinery and pipe-lines on the Comstock Lode, for the Spring Valley Water Co., and for several Hawaiian sugar-plantations, also the equipment for many of the hydro-electric plants of the Pacific Coast. In fact he had a prominent part in most of the important enterprises in the development of the metal industries of the Pacific Coast. He is survived by his widow and by his four sons, David, Jr., John G., George D., and Robert Dorward.

Hermann Schussler died of heart failure April 27 at his home at 1905 Van Ness avenue, San Francisco. He was born in Germany in 1842, was educated at the Polytechnique of Zurich, Switzerland, and came to San Francisco in 1864, largely, as he frequently remarked during the past five years, because he did not like Prussianism. He entered the service of the Spring Valley Water Co. and continued in its employ for 51 years most of this time as chief engineer for the company. During this time he had charge of the construction of practically all the present system of the company, as well as the examination and acquisition of the various undeveloped watershed lands owned by the company. Besides his work for the Spring Valley Water Co., he had a large consulting practice, being connected with many projects in the Pacific Coast States as well as Nevada and Hawaii, specializing on hydraulic work. In particular, he probably had charge of the construction of a greater mileage of large riveted iron and steel pipe-lines than any other engineer. In 1915, Mr. Schussler severed his connection with the Spring Valley Water Co. and devoted himself entirely to his private practice, which he continued actively until his death. He particularly enjoyed calling attention to the fact that some of his clients were the sons and grandsons of earlier associates. He is survived by his widow, and by three children, Mrs. Martin Preuss, Miss Alice Schussler, and Dr. Hermann Schussler.

John Llewellyn, vice-president of the Llewellyn Iron Works of Los Angeles, died suddenly April 23 in New York, where he had gone on a business trip. Mr. Llewellyn was born in Wales, but the family came to America when he was four years old. His father, David Llewellyn, was one of the pioneer foundrymen of San Francisco. About thirty years ago, John Llewellyn and his brothers, Reese, William, and David, went to Los Angeles and founded the Llewellyn Iron Works, which has become one of the most important plants in the metal trades in southern California. Mr. Llewellyn was unmarried. He is survived by his mother, Mrs. Hannah Llewellyn, his three brothers, and by a sister, Mrs. John Milner.

Market Review

Failure of the price stabilization plan has made the iron and steel market all over the country unsettled and dull, and San Francisco and the Pacific Coast in general is no exception to the rule. Apparently, the market must continue to drift until readjustment proceeds far enough for reviving demand to stiffen prices. Very few sales are being made but prices are, nominally at least, unchanged. The only important local contract awarded during the month was that for the materials for the structural shop at Mare Island Navy Yard, which, after being up for bids several times was finally awarded to the American Bridge Co. at $93 for 6120 tons of structural steel and 85 tons of crane-rails, $0.069 for 53,300 lb. of steel stair-framing, and $0.0995 for 70,000 lb. of cast-iron treads and landings.

The scrap market is also dull, with the further complication that the steel mills are trying to force a reduction in the price of steel scrap below the figures that dealers are willing to accept. The mills are offering $14 per gross ton, while the dealers are trying to maintain the present figure of $18. No. 1 cast-iron scrap is being sold at $37.50 per net ton.

Ruling prices on non-ferrous metals are as follows:

Copper	16.00
No. 1 red ingot brass	16.00
No. 1 yellow ingot brass	12.00
Electrolytic zinc	9.00
Prime Western zinc	7.50
Lead, carloads	5.25
Antimony	7.00

The market for old metals is unchanged and dull.

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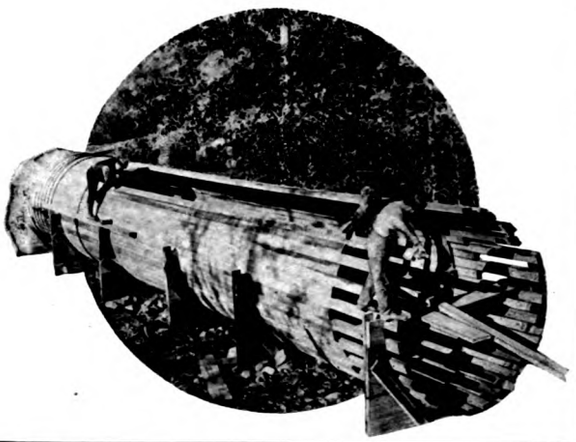

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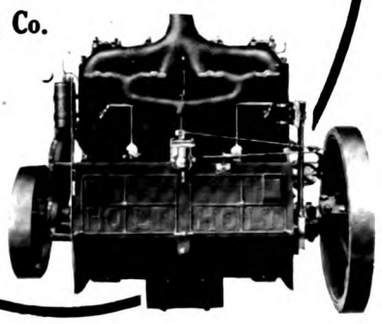

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of METAL TRADES, published monthly at San Francisco, California, for April 1, 1919

State of California, } ss.
City and County of San Francisco }

Before me, a notary public in and for the State and county aforesaid, personally appeared Chas. T. Hutchinson, who, having been duly sworn according to law, deposes and says that he is the business manager of METAL TRADES, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher, WESTERN ENGINEERING PUBLISHING CO., Inc. ..... San Francisco, Cal.
Editor, CHAS. T. HUTCHINSON ..... " " "
Managing Editor, CHAS. T. HUTCHINSON ..... " " "
Business Manager, CHAS. T. HUTCHINSON ..... " " "

2. That the owners are: (give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock). Dewey Pub. Co., San Francisco, Cal.; T. A. Rickard, San Francisco, Cal.; C. T. Hutchinson, San Francisco, Cal.; Philip Argall, Denver, Colo.; J. F. Kemp, New York City; L. S. Austin, Los Angeles, Cal.; J. Parke Channing, New York City; H. F. Dexter, Alameda, Cal.; Lewis T. Wright, London, England; L. A. Greene, San Francisco, Cal.; H. W. Baker (Estate), San Francisco, Cal.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: Dewey Publishing Co., San Francisco, Cal.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustee, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is ..... (This information is required from daily publications only.)

CHAS. T. HUTCHINSON.
Business Manager.

Sworn to and subscribed before me this 27th day of March, 1919

(Seal) HENRY B. LISTER.
Notary Public.

(My Commission expires Feb. 1, 1922.)

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